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Intermaxillary elastics use with orthodontic biomechanic

A Project Submitted to
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Partial Fulfillment for the Bachelor Degree in Dental Surgery

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Supervisor Certification

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List of Abbreviations

Abbreviation	Description
AP	Anteroposterior
CRs	Center of resistance
CR	Center of rotation

Introduction:

The purpose of orthodontic treatment is to create tooth movement that ultimately leads to properly aligned and interdigitated teeth. When done appropriately, functional and esthetic results are produced.

Light continuous force levels are recommended during orthodontic tooth movement to promote bone and gingival health. These light force levels allow for cell survival within the periodontal ligament and remodeling of the tooth socket through frontal resorption rather than necrosis and undermining resorption. Anterior-posterior (A-P) movement of teeth can be accomplished in a variety of ways. Some options include intraoral elastics, elastomeric chains, removable appliances, coil springs, functional appliances, and extraoral devices. Bratu 2004

Elastic and elastomer are widely used in the field of orthodontic. Elastics have been an indispensable accessory of any medical treatment for years. When used with good patient coordination, it allows the doctor to correct both anteroposterior and vertical deviations. , Fleser 2005

Both natural rubber and synthetic elastomers are widely used in orthodontic treatments. It is generally made of elastic latex, which is used to provide intermaxillary traction and intramaxillary force in the Begg technique. Synthetic elastomeric materials in the form of chains find their greatest application with edgewise mechanics where they are used to move the teeth along the arch wire.

intramaxillary elastics or intra-arch elastics These extend within each arch. This is used for the space closure and to a certain extent; it can open the bite also. It is placed from the molar tube to the intramaxillary hook of the same side of the same arch and can be also called as intra arch elastics. The force recommended is 1 1⁄2 to 2 1⁄2 oz for non-extraction cases and 2 to 4 oz. in extraction cases.

Intermaxillary elastics have become an integral part of treatment with fixed orthodontic appliances, aligners, and a combined orthodontic–surgical approach. When indicated appropriately and with good patient compliance, they can reduce the duration and increase the efficacy of ongoing orthodontic treatment. Elastics can be used along with an orthodontic appliance within one dental arch, in an intermaxillary manner between the upper

and lower dental arches, or can be attached to intraoral as well as extraoral auxiliary appliances. Langlade 2000

Depending on the material used, elastic can be divided into latex-elastic and latex-inelastic; They can be further reduced in size and size. It is important that the elastic used meets the requirements and provides the desired strength for as long as possible when used by the patient. Elastics are known for their breaking strength, which gradually decreases with wear. That's why doctors usually advise patients to change the elastic every 8 hours or after 12 or 24 hours;

However, clear guidelines regarding elastic replacement time are lacking.

The present study tried to verify the most familiar method to orthodontist for using intermaxillary elastics which is very important in biomechanics in orthodontic treatment.(1957 Reitan8)

Aim of study:

To evaluate the importance of intermaxillary elastic and uses during the orthodontic treatment.

Chapter one

Review of Literature

1.1 Orthodontic Force

The formation of teeth is determined by the amount of force applied and the strength of that tooth or teeth. When force is applied over time, it causes changes in the alveolar bone. This feedback can be seen in different ways depending on the energy used. The periodontal space is strongly clogged, its width decreases, causing changes in it. If the force is large, pain will occur and cell necrosis will occur due to absorption of damage. Hyalinization is a term often used to describe cell-free tissue. The gentle force connecting to Cell Health does not cause pain and increases absorption in the tooth. This change causes the teeth to move.

The trend in orthodontics has moved over time to the use of light continuous forces to create tooth movement. With these forces, tooth movement is achieved while limiting the amount of pain.(Proffit 2018)

Andreasen explained that the definition of a “light” force is somewhat
ambiguous and he noted that no one, including Reitan had defined the term. He continued by offering the range of 50-200g that Reitan used in his intraoral histological studies of tooth movement as a reference point for intermaxillary elastic force levels.

Manufacturers recommend intermaxillary elastics ideally be stretched three times the lumen width and they have the corresponding ounces and grams of force to be expected listed for reference.

In 1977, Bales found that the force levels were typically higher than reported by the manufacturers. When using Class II elastics, Proffit1recommends 250g per side with a rectangular wire and half that amount, 125g, when using a lighter round wire.

Bishara recommends approximately 300g per side for interarch movement. Langlade calculated optimum tooth movement force levels based on Ricketts root resorptive surface area model of 150g of force per cm^2. This amounted to 318g per side when moving one arch relative to the other.

Table 1 : Elastic Force(Zimmer (September 1, 2012).

Force Rating	Force (oz.)	Force (g)
Light	2 oz.	56.7 g
Medium-Light	3 1/2 oz.	99.2 g
Medium	4 oz.	113.4 g
Medium-Heavy	5 1/2 oz.	155.9 g
Heavy	6 oz.	170.1 g
Extra Heavy	8 oz.	226.8 g

1.1.1 Advantage of Elastic

Elastics have several advantages over other orthodontic resources, such as:

1- Low cost

2- Removable

3- Facilitating feeding and hygiene

4- Easy insertion and removal by patients

5- Esthetically acceptable in most applications

6- Great versatility in orthodontic biomechanics.

1.1.2 Disadvantage of elastic

The main disadvantages of elastics include

1. Need for the patient's cooperation

2. Degradation in the oral environment

3. Side effects such as root resorption, occlusal plane asymmetries, allergic reactions and dental rotations, among others Barrie wm (1974 jul)

1.2 Composition of Intraoral Elastic

The performance of natural rubber has always been limited by poor thermal behavior and water retention. In 1839, Charles Goodyear was the first to heat a mixture of sulfur and rubber, known today as vulcanization. This has significantly increased the possibilities of using natural rubber. Singh 2012

Although traditional rubber used in orthodontics was first tested and published in the 1890s, the use of elastics did not become more widespread until the 1960s. As our knowledge has increased, manufacturers have added other ingredients such as antioxidants and antiozonants to reduce the limit of elasticity and extend its life. other substances such as resins, proteins, sugars and mineral substances. Latex is quickly converted into unbleached rubber after being beaten to prevent degradation.

Today, traditional intermaxillary elastics were made primarily from natural latex rubber until the early 1990s, when they were marketed for patients with latex allergies or sensitivities.

Options are varied for orthodontists with many manufacturers, sizes and force levels available on the market Orthodontic manufacturers alter the variables of size and force to fabricate a spectrum of intraoral and extraoral elastics. These elastics are used by orthodontists to meet the individual force level needs to correct their patients' malocclusions.

The variable of size is established off the initial lumen length and standard sizes range from 1/8" to 3/4" with the most commonly used sizes ranging from 3/16" to 5/16". The variable of force is normally reported in ounces. Standard force levels range from 2 to 14oz, including extraoral elastics.

The most commonly used force levels intraorally range from 3 to 6oz. Intraoral and extraoral options are available for use with different appliances or devices.

Baty, storie 1994

1.3 Elastomer Degradation

The term elastomer is used by chemists to describe any material, such as natural and synthetic rubber, that can stretch several times its length and return to its original shape when released. Kanchana and Godfrey reported that, as expected, the energy level increases as the lumen lengthens, and decreases as the lumen length decreases. The initial power level varied greatly from manufacturer to manufacturer.

Initial power levels were 9.5% to 41.9% higher than normal power levels. The magnitude and severity of elastic deformation were very different. Overall, they found a 70% energy retention after one hour and a 64% energy retention after three days. They found that 81%

of the initial energy was retained after 30 minutes and 75% after 24 hours.

Degradation is greater in vivo than in vitro in wet or dry environments. They stated that the larger the lumen size and/or the smaller the effective power, the greater the energy loss. There are many factors that can cause elastomers to deteriorate over time.

Mapare S, Bansal K,2018

1.4 Types of Intermaxillary Elastics

1.4.1 Anteroposterior Intermaxillary Elastic.

1.4.1.1 Class II (AP) Intermaxillary Elastic. (long / short).

probably mostly intermaxillary elastics in orthodontic procedures. It is horizontally oriented and its purpose is to correct the existing secondary relationship by moving the upper teeth backwards and the lower teeth forward.

In addition to the traditional indications for the second stage of sagittal relationship correction, it can also be used to assist with the loss of the lower back or the extraction of the space created by the front teeth in front of the diastema or.

In 1959, Wein, reported his findings regarding the effects of degree internal elastics on cephalometric measurements. In comparison, SNA decreased slightly, SNB increased slightly, ANB decreased, and maxillary incisor decreased slightly while mandibular incisor decreased.

Recently, Reddy reported severe reduction in ANB angle and Wits along with severe mandibular growth in stage II children.

They also found a significant increase in front and rear height with the length. These findings are consistent with our knowledge that vertical and horizontal forces are involved with the use of secondary intermaxillary orthodontic elastics.

Jayachandran S, Wiltshire WA, Hayasaki SM,2016

- **Size, Force, And Wear Time**: The most suitable for this application are the 1/4-in, 5/16-in, or 3/8-in medium strength elastics.

Initially, during the period we call the active phase, they should be ideally used for 24 h, being removed only for food and hygiene.

When the desired results are obtained, we move on to the retention phase that should last two months on average, using the same size of elastic, but with light force and still for 24 hours a day. Finally, it is also possible to carry out the post-retention phase, as a guarantee of maintaining the results obtained. At this stage, the light elastic should be used for 12 hours a day for one month
Janson G, Sathler R 2013

- Side Effect: The effects of Class II elastics should be considered with the individual case in mind before prescribing the elastics. These effects include:
1. Proclination and intrusion of the mandibular incisors
2. Palatal tipping, retrusion, and extrusion of the maxillary incisors
3. Mesialization and extrusion of the mandibular molars
4. Clockwise rotation of the occlusal and mandibular planes.
5. Root resorption

These effects are mainly dentoalveolar, Janson further explained that the occlusal plane angle has a tendency to return to its original position later.
Stanley found no statistical difference in system energy produced between using lightweight archwire (0.014 in. Nitinol) or heavy (0.019 x 0.025 in. stainless steel) archwire and lightweight elastic (2 oz).

Because compliance is best when the patient is young and/or early in treatment, Stanley says early light therapy may be reasonable. The use of a heavy archwire reduced the amount of additional force found on the large canines and mandible when using a heavy elastic (4.5 oz). This should be taken into account if the treatment plan includes reducing tooth extraction. Jayachandran S, Wiltshire 2016



Figure 1: Class II intermaxillary elastic(Guilherme)

1. Long Class II Elastic:

A single force from a Class II elastic can be replaced with an equivalent force system at the CRs of the maxillary and mandibular arches.

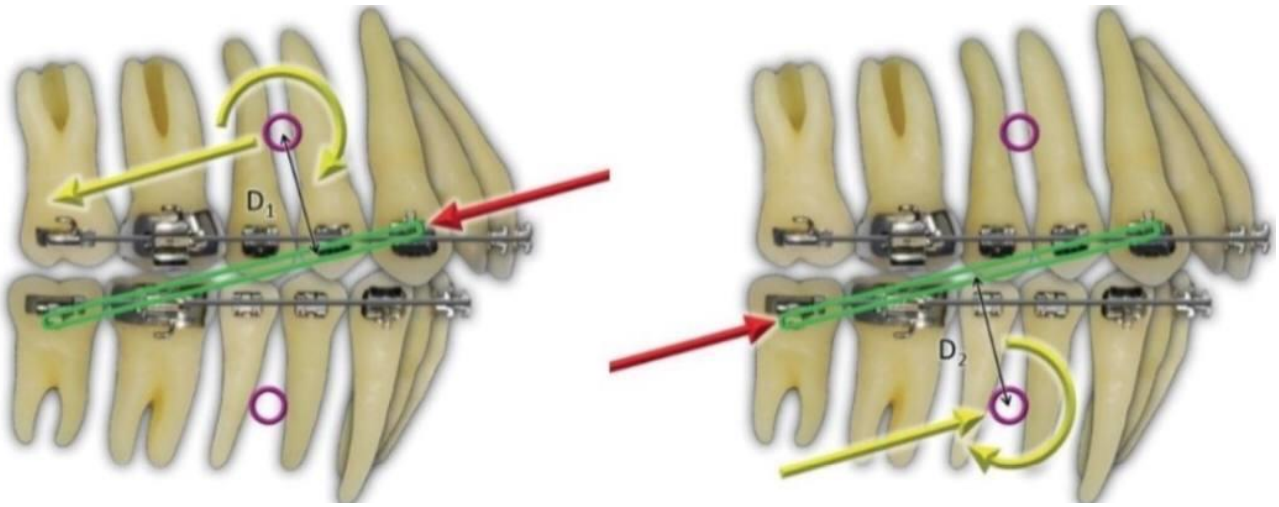


Figure 2 : long class ll intermaxillary elastic(Behrent2014)

Both arches rotate synchronously in the same clockwise direction because of the same magnitude and direction of the moments. If the occlusal planes rotate by the same amount, the overbite will be maintained. Ferreira TJN, Silva CC,2008

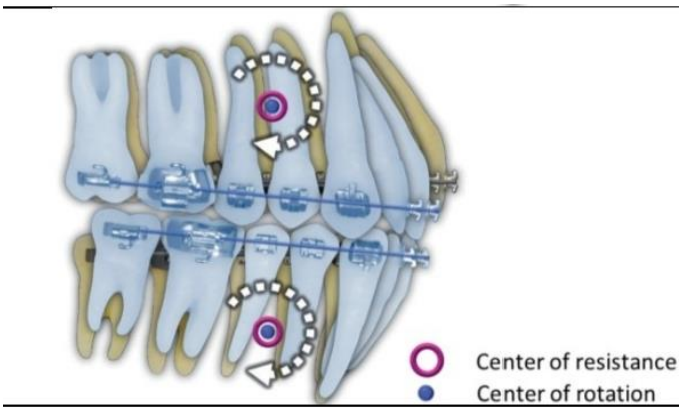


Figure 3: rotation in clockwise direction assosciated with use of elastic in long class ll cases (Behrent2014)

Lateral superimposition of cephalometric radiographs before (black) and after (red) of long-term use of Class II inter-maxillary elastics in an extraction case using round wire. Both the maxillary and mandibular arches rotated in a clockwise direction, with extrusion of the maxillary anterior teeth and mandibular posterior teeth. Martins2016

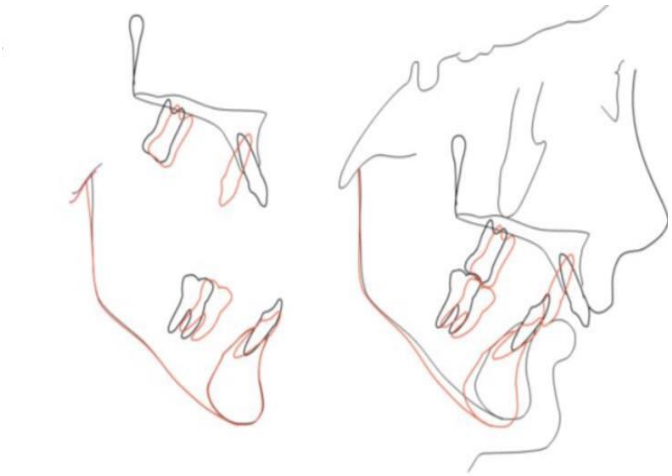


Figure 4 : lateral superimposition of cephalometric (phulari2013)

Since the force is acting from the buccal, the mandibular second molar will move in a superior direction; and at the same time, the moment produced by the elastic at the CR will

tip the molar crown lingually.

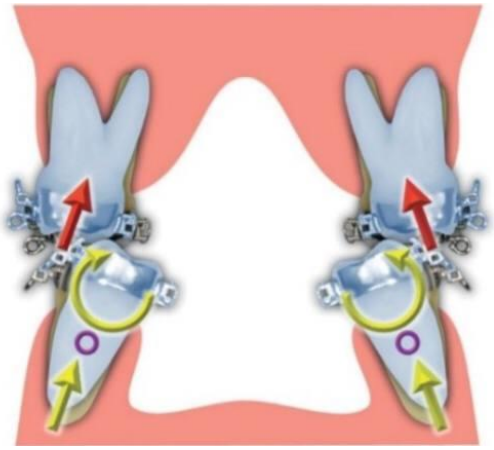


Figure 5: frontal view of long class ll elastic(Renata; Fernandes2013)

2. Short Class II Elastics

When a single force from the elastic is replaced with an equivalent force system at the CR of each arch, the moment is lower and the vertical component of force is greater than that with the long Class II elastic.

Nelson B, Hansen 1999

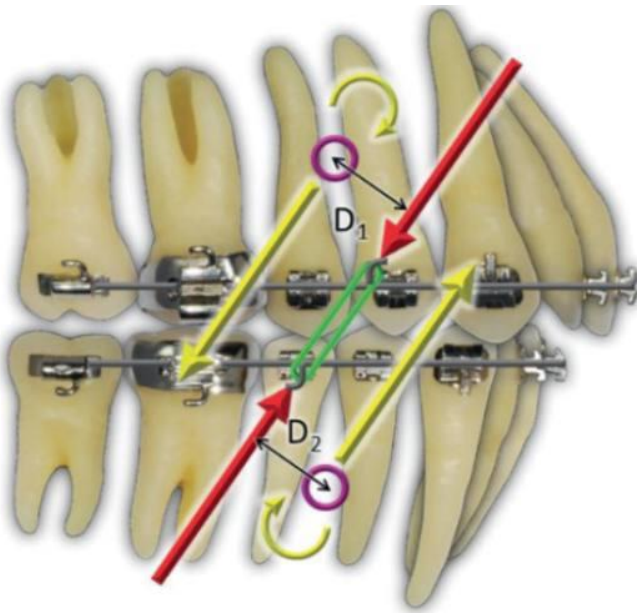


Figure 6: short class ll elastic(choy2011)

3. Synchronous or Asynchronous

Short Class II elastics may be synchronous or asynchronous.

In synchronous elastics, the CR is an equal distance from the force in each arch (D1 = D2).

In asynchronous elastics, the line of action of the force passes through the CR of one arch creating a translatory effect with no moment and hence no rotation.

But a large moment is produced at the CR of the opposing arch rotating it clockwise leading to a lack of occlusal plane parallelism and an increase or decrease in overbite. Janson G, Freitas MR 2010

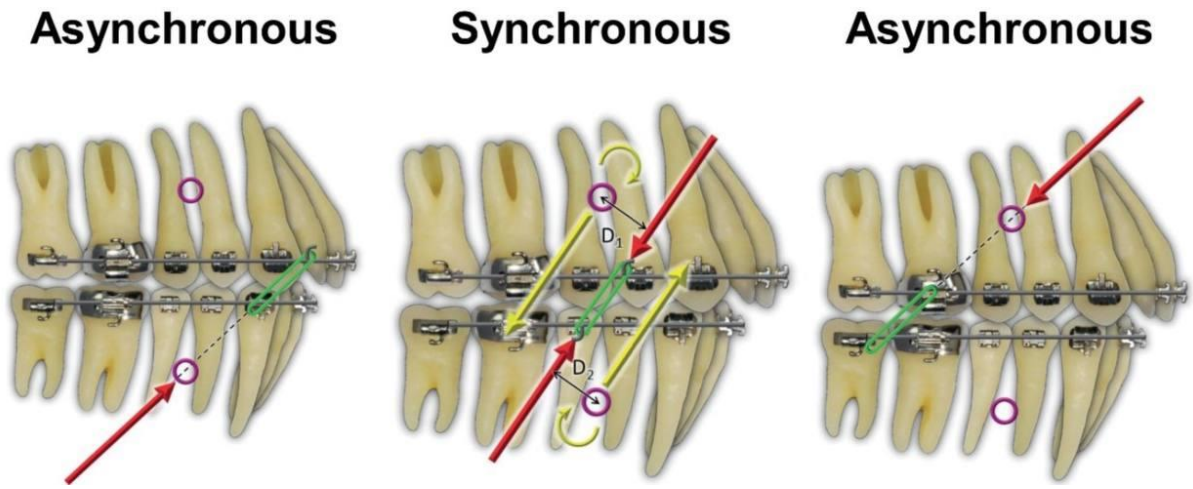


Figure 7:: synchronous and asynchronous (Behrent2014)

A. Placed Posteriorly

The force passes through the CR of the spring and hence there is no backlash. However, more time is spent rotating the mandibular arch clockwise to open the bite and reduce overbite.

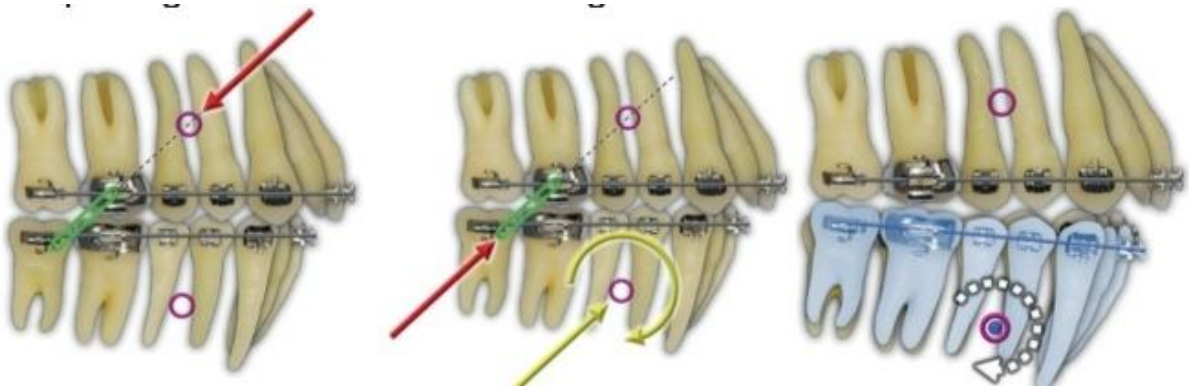


Figure 8 : elastic placed posteriorly(Behrent2014)

B. Placed Anteriorly

The force passes through the CR of the mandibular arch and hence no moments. However, a large moment is produced at the CR of the maxillary Sobral MC, Habib FA,2013 arch rotating it clockwise steepening the bite and increasing overbite.

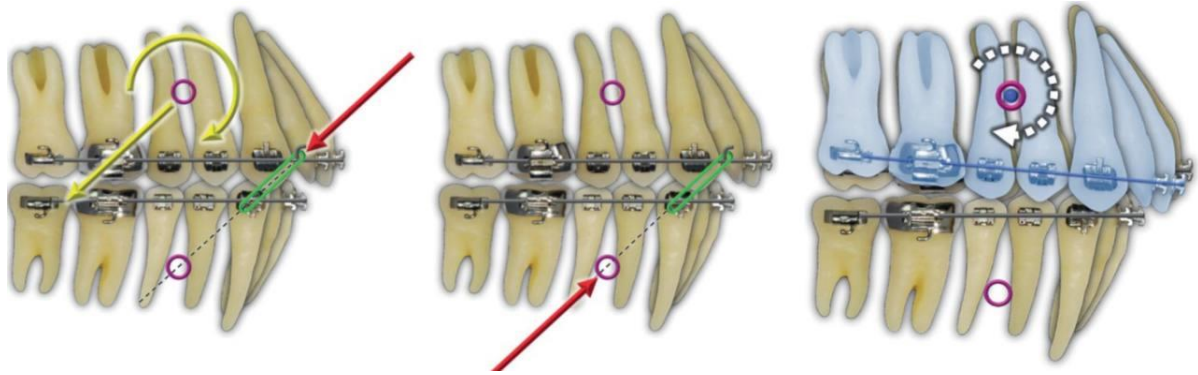


Figure 9: elastic placed anteriorly(Behrent 2014)

Class II Open Bite

Short Class II elastic force passes through the CR of the mandibular arch producing a large moment in the maxillary arch, closing the open bite and reducing the Class II malocclusion. The cant of the mandibular plane of occlusion will not change.

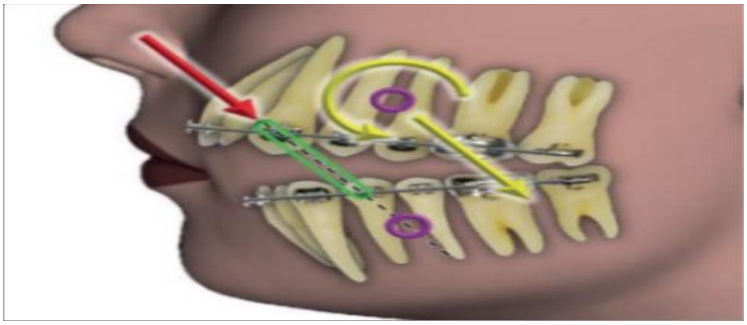


Figure 10: case 1 show class ll open bite(Marcos Roberto2013)

Class III Open Bite, Short Class III elastic force passes through theCR of the maxillary arch producing a large moment in the mandibular arch, closing the open bite and reducing the Class III malocclusion. The cant of the maxillary plane of occlusion will not change.

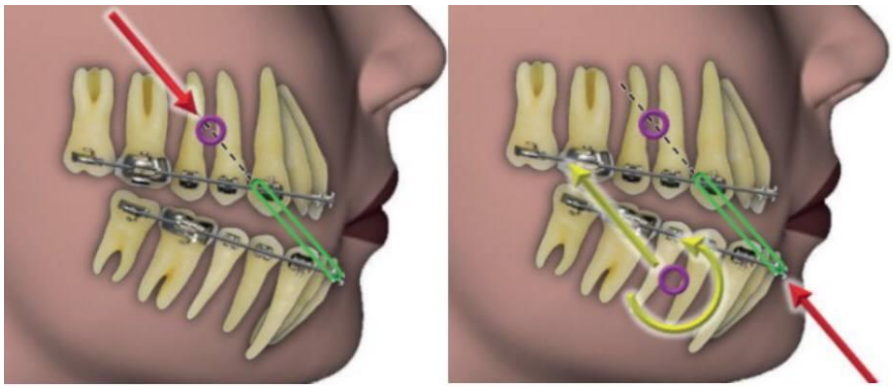


Figure 11: case 2 show class lll open bite(Marcos Roberto2013)

Short elastic Class II Vs long elastic Class II

The direction is different, with the short elastic having a greater vertical component of force in comparison with the horizontal force. Perhaps of more significance are the equivalent moments at the CR, which are much smaller than those with the long elastic. Treatment goals can vary in respect to the level and can't of the treated occlusal plane.

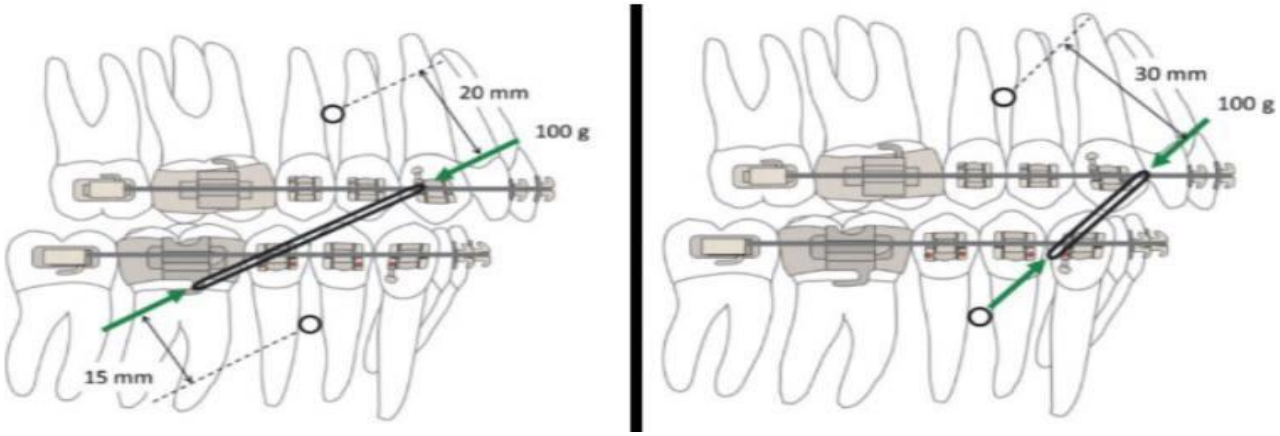


Figure 12 : Comparison of short Class ll elastic and long Class ll elastic(little wood 2019)

The short elastic will not steepen the occlusal plane very much; The results of the increased vertical force also depend on the occlusal forces and function:

* Patients can grow vertically, and the eruption of teeth can be masked with the increased vertical dimension.

* Some patients with flatter mandibular planes are highly resistant to an increase in

vertical dimension from the extrusive component of the elastic.

* Non-growing adult patients usually show little increase in vertical dimension following treatment.

The long elastic that produces a large movment around the CR will extrude the mandibular second molar. For every millimeter of molar eruption, the mandible could rotate, significantly reducing the overbite by 2 to 3 mm. Because it is the moment that rotates the arch, short elastic may be more conservative in preserving vertical dimension even though the vertical component of force is greater.

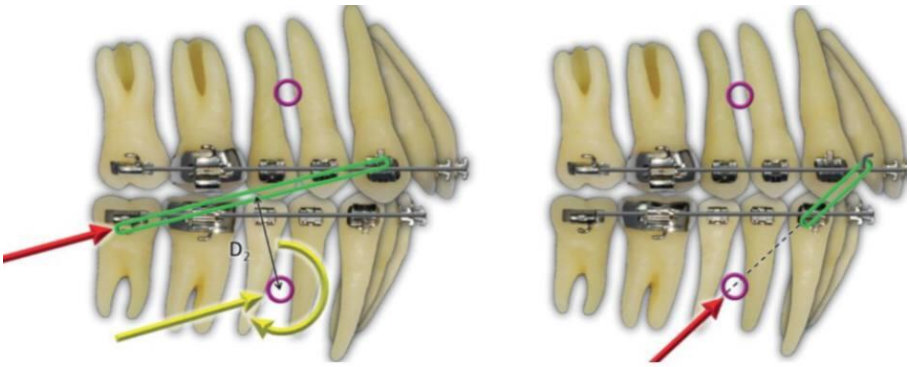


Figure 13: long Class ll elastic movment (Behrent 2014)

1.4.1.2 Unilateral Class II or III.

anson G, Carvalho PEG, 2016

Anteroposterior elastics (AP) can be used on one side if we want to correct asymmetry on one or both sides. The most common effect in these cases is tilting of the occlusal plane in the frontal view (axis of the arch) as a result of the force of extrusion that occurs on one side, especially in the front part of the upper arch, when II. class flexible. is used, and in the front region of the lower arch, if III. used in the flexibility of the class. In the occlusal view, the maxillary arch tends to rotate around the CR and can produce a buccal crossbite on the affected side.

In the frontal view, the moments produced can rotate both arches causing an open bite on the left side. However, the mandibular arch rotates more because D2 > D1.

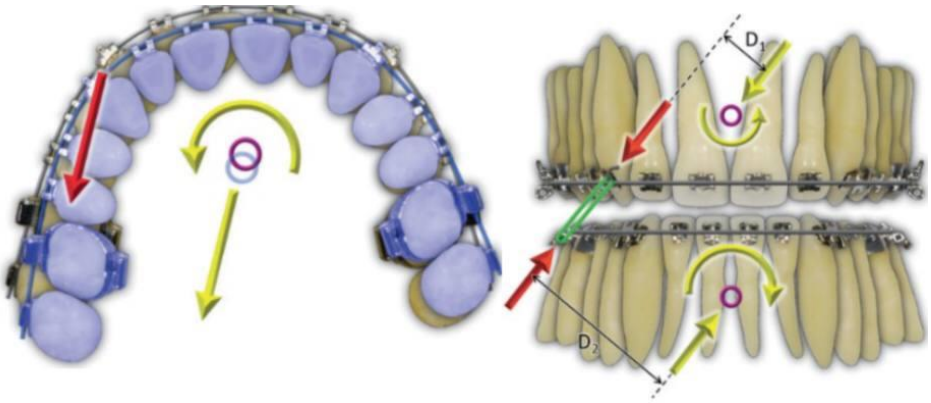


Figure 14 : A/occlusal view of unilateral Class ll elastic
B/frontal view of unilateral Class ll elastic (Mitchell 2013)

Patient treated with unilateral Class II elastic on the left side, without control of side effects, promoting can't of the upper occlusal plane (roll axis) and need for retreatment to level the plane by means of intrusion with a miniscrew, followed by extrusion of the lower arch with vertical elastics.(Eltahir 2017)



Figure 15: Patient treated with unilateral Class ll intermaxillary elastic (Eltahir 2017)

Patient treated with unilateral Class II elastic in the final phase of treatment, promoting cant of the lower occlusal plane (roll axis) by extrusion of the posterior region and intrusion of the anterior region on the left side. Vertical elastic was then used on the left side, associated to an asymmetric curve in the archwire to level the lower plane. The upper arch required slight extrusion on the left side, so the extrusive effect was not considered adverse, as it

promoted the leveling of the upper arch.

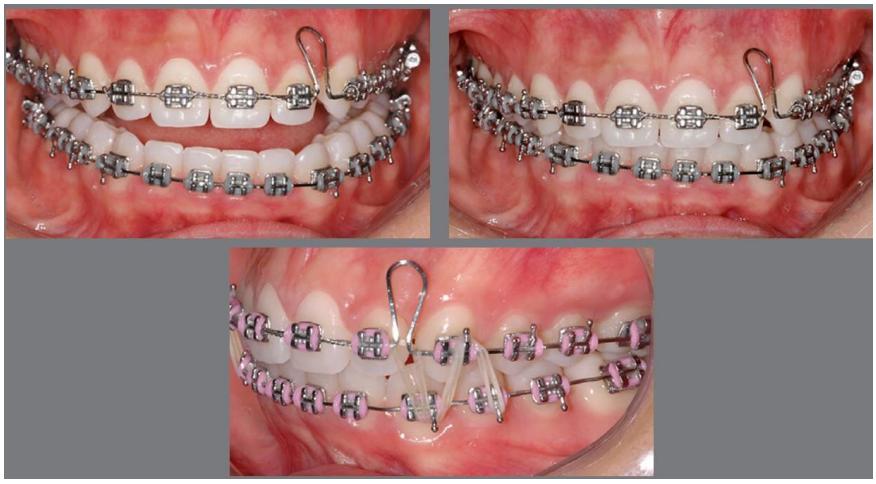


Figure 16 : Patient treated with unilateral Class II elastic in the final phase of treatment (Eltahir 2017)

SLIDING JIG

One way to reduce the side effects of using AP intermaxillary elastics on both sides is to insert a marker such as a glide device.4,8 The glide device reduces abnormal forces in the anterior region by lengthening the horizontal contour lines.

Compared to standard elastics and in both class II and class III, the differs in that it reduces the tendency for asymmetric reduction and the inclination of the arch plane by spreading the force of the intermaxillary elastic space in the posterior region.

Patient treated with a unilateral Class II elastic associated with a sliding jig. In this case, the patient chose not to use skeletal anchorage or to extract a premolar; so, to minimize side effects, mechanics with a sliding jig was used for tooth-by-tooth distalization and correction of the Class II, subdivision right Ruellas ACO 2013

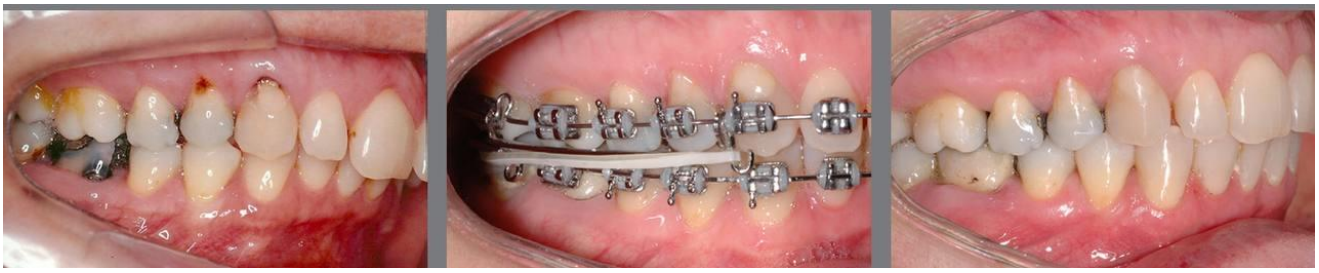


Figure 17 : sliding jig in patient with unilateral Class ll intermaxillary elastic(Ruellas 2013)

1.4.1.3 Class III.

The primary purpose of Class lll elastics is to move the upper teeth and lower teeth mesially apart and is very similar to Class ll elastics in terms of marine priming, wear time, strength and impact control.

However, it can be specified when increasing the anchorage loss in the upper part is desired due to the rotation of the walls, or when a return to the lower part is desired when there is a gap created by diastema or extraction.

In addition, during surgical procedures in a class II patient, when it is desired to increase the overjet by replacing the front teeth or straightening the front teeth;

Connection/ Class III of rubber bands should be placed on the second maxillary molars, if present, and contain a bow, attached to their welded hook at the lower edge of the area between the lateral and canine teeth 4,6,8 III. class status. It is flexible, if the excess allows, a hook can be secretly placed on the lower bow, so a direct result can be achieved. If the overbite does not allow it, the cast can be placed in the cervix. II. as a class elastic material, direct contact with canine should be avoided Cabrera MDC, Cabrera CAG, Henriques JFC, Freitas MRD,

Janson G.2003

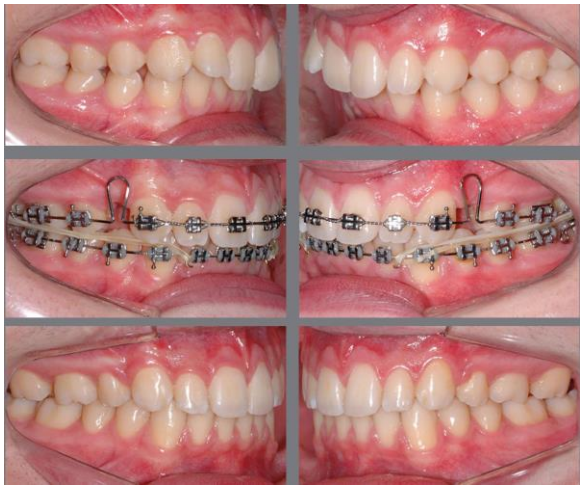


Figure 18 : Class lll intermaxillary elastic (Riojas2010)

Patient treated with Class III 5/16-in elastics of medium force. In this case, Class III elastics were used as a resource to increase the loss of anchorage in the upper arch after extraction of the first premolars, and as a resource to improve the inclination of the lower incisors that were proclined before treatment, facilitating the finishing procedures with correct overjet and overbite.(Riojas2010)

The use of elastics with a Class III correction direction will also promote important side effects. These side effects include counterclockwise rotation of the occlusal planes (pitch axis), increased vertical dimension due to extrusion of the maxillary molars, uprighting of the mandibular incisors, projection of the maxillary incisors, distal tipping of the mandibular poste- rior teeth, and mesial tipping of the maxillary posterior teeth .

Patients with Class III malocclusion usually have reduced and increased display of the maxillary anterior and mandibular anterior teeth when smiling, respectively. The tendency with the use of Class III elastics is to rotate the planes counterclockwise, which will further reduce exposure of the maxillary anterior teeth. Therefore, in these cases, pro- longed use of Class III elastic should be avoided, and maxi- mum control of side effects should be ensured. Alternatives such as skeletal anchorage, orthognathic surgery Koyama I, Iino S, Abe Y, Takano-Yamamoto T, Miyawaki S

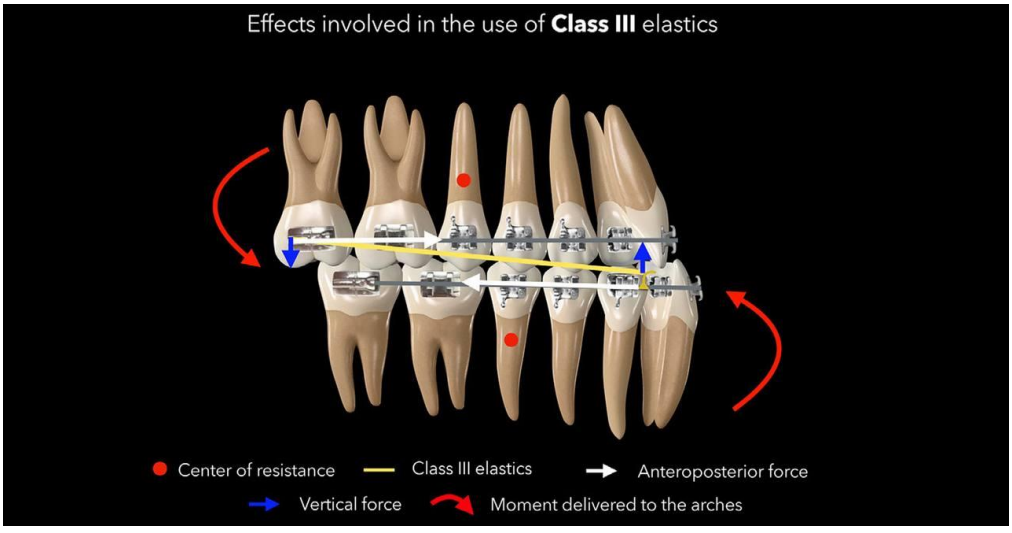


Figure 19 : Direction of Class III intermaxillary elastic(cheng 2012)

1.4.2 Transversal Intermaxillary Elastic

Intermaxillary elastics can also be used in a different direction in cases where a crossbite, buccal (Brodie bite) or even small deviations in the midline need to be corrected**.**

1.4.2.1 Crossbite.

Regarding the use of rubbers to correct crossbites or buccal crossbites, it is possible to use lingual connection buttons, while buccal contact can be made directly with knots, screws or welding, or by bending wires such as omega , delta or loops.

- Size, Force, And Wear Time For bite correction, a 1/8 inch rubber band is the usual choice, and if the first fails, a heavy rubber band can be used. As with other intermaxillary gums, it is recommended to be used during the day, only to be removed for feeding and hygiene. A crossbite often requires the use of a bite plane, which allows cutting and prevents the gum from cutting the occlusal bond between the upper and lower teeth.

Cross elastics are commonly placed on individual molars, on an entire posterior segment, or on a full arch. Force magnitude and direction can vary depending on jaw opening and hook placement

Chacko A, Tikku2018

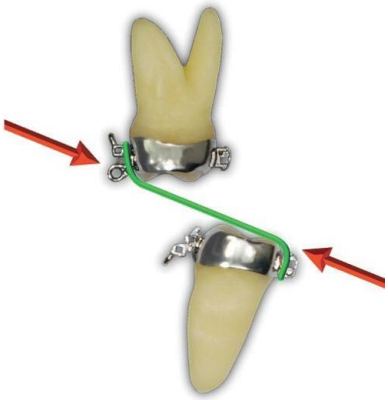


Figure 20: posterior cross elastic in proximal view (charles , Burstone 2011)

Unilateral Posterior Cross-elastic in a continuous arch: The force is asynchronous and is closer to the mandibular CR than the maxillary CR causing rotation of the arches and an open bite on the left side.

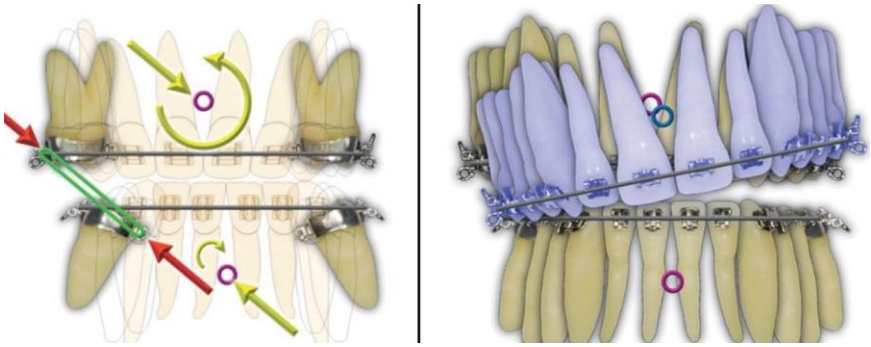


Figure 21: Unilateral Posterior Cross-elastic in a Continuous Arch choy2011

To balance the movment created by the unilateral posterior cross-elastic, a vertical elastic force is applied on the left side. The vertical elastic's moments at the CR are equal and opposite to the moments from the cross-elastic on the right side

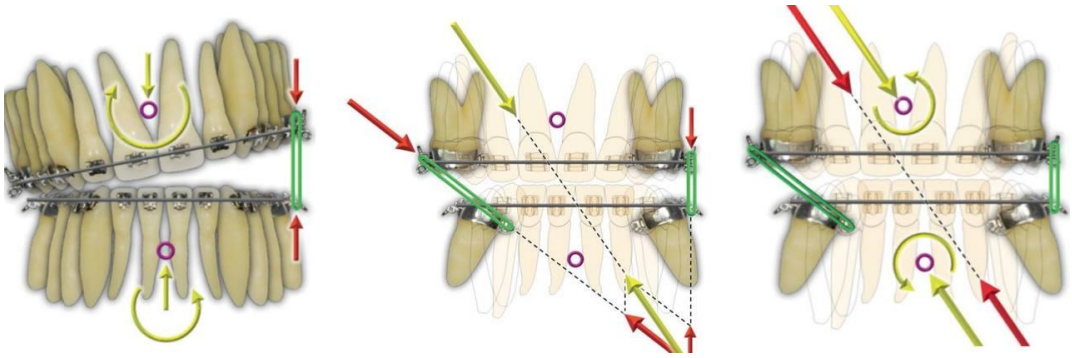


Figure 22: the vertical elastic added to cross elastic to balance the movment (charles , Burstone 2011)

Unilateral Posterior Cross-elastic (Occlusal View). An elastic placed at the first molar rotates the arch in a counterclockwise direction. Arch rotation will be produced unless the force passes through the CR of the arch (first premolar area) Zimmer B, Nischwitz D.2012

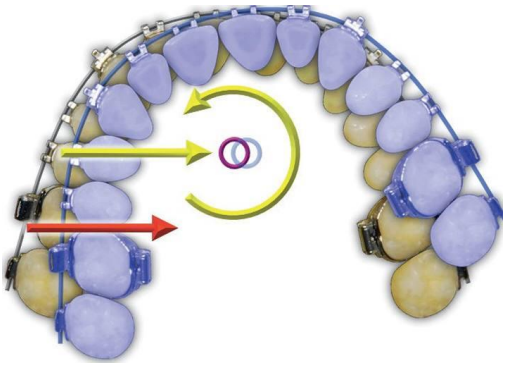


Figure 23: Unilateral Posterior Cross-elastic (Occlusal View) (charles , Burstone 2011)

1.4.2.2 Midline

Fastener/rubber elements required for centerline correction must be provided with welded or pinch hooks. In such cases, priority should be given to the results of vertical forces; Therefore, set the upper hooks down and the lower ones up, if the overbite allows.

For midline correction, the flexibility of choice is usually 3/16 mid force, which distributes about 100 gf. It is important to note that this elastic band should not be used for long periods of time during treatment, as there is a risk of significant side effects with the use of midline correction elastics, the most common side effects are the cant of the occlusal plane (roll axis) due to the vertical component that forms during use, and incorrect angulation of the anterior teeth due to the application of a force that is more occlusal in relation to the center of resistance of anterior teeth Girsa P, Singh AK, Kannan S, Arora N,**2021**

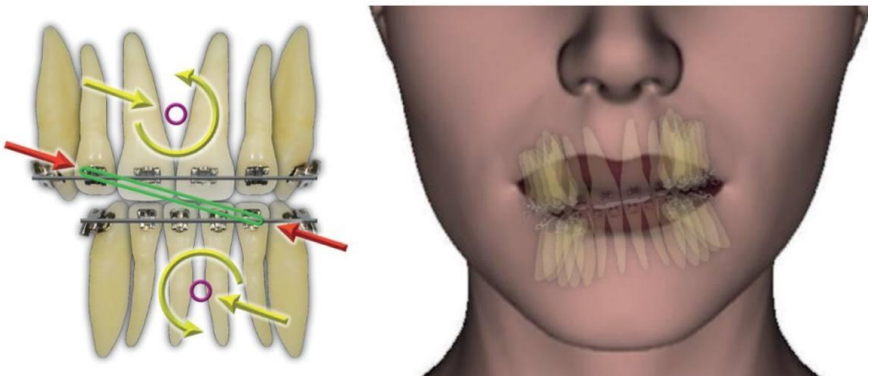


Figure 24: Midline elastic(charles , Burstone 2011)

Anterior Midline Elastics (Off Centre) Here the maxillary occlusal plane rotates very little or not at all because D1 is very small. Therefore, the cant of the maxillary occlusal plane will be maintained. An open bite may occur on the right side because of the counterclockwise rotation of the mandibular arch due to the large moment at the mandibular CR (large D2)

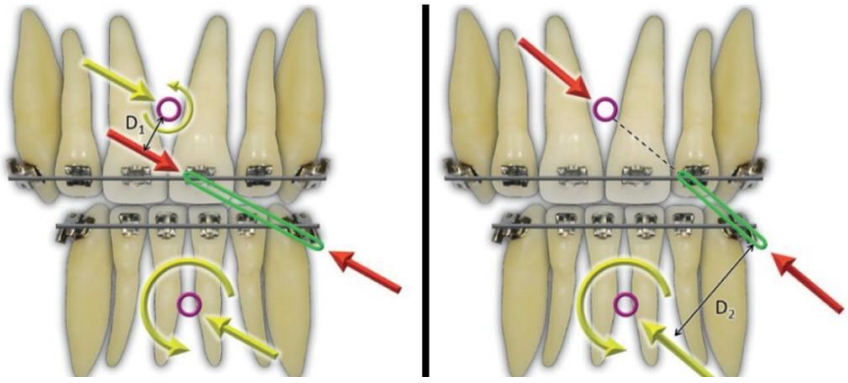


Figure25: Anterior midline elastic (charles , Burstone 2011)

Class II Elastic – Class III Elastics The resultant forces of a Class II elastic on the right side and Class III elastic on the left side shows that both arches will rotate synchronously in a clockwise direction. Marpe 2018

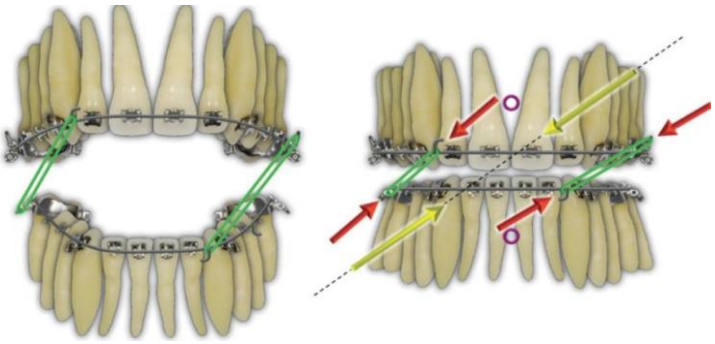


Figure 26: Anterior midline elastic in class II and class III(charles , Burstone 2011)

1.4.3 Vertical (Intercuspation)

Vertical elastics are used to improve the vertical intercuspation relationship between the upper and lower teeth. Like AP elastics, they lead to both desired effects and side effects that may or may not be desired.

1.4.3.1 Class I, Class II or Class III (bilateral posterior).

Anchorage Preparation: As with the use of AP elastics, the preparation of one or both arches is necessary for the correct use of vertical elastics, for the control of side effects. It is recommended to use a rectangular steel arch wire, preferably 0.019 × 0.025-in, to control the torque of the posterior and anterior teeth.

Connection: When vertical elastics are being used, the connection can normally be made in two ways: directly on the brackets, when they already have hooks; or connection on hooks clipped to the arches, positioned between two brackets. Normally, the connection to clipped hooks present a lower risk of side effects;

Side Effects: The most common side effect that occurs as a result using vertical elastics is the change in torque, with movement of the crown to the lingual and roots to the buccal, due

to the formation of a moment of force during the buccal force application in relation to the center of resistance of the teeth.

Greenberg 2012

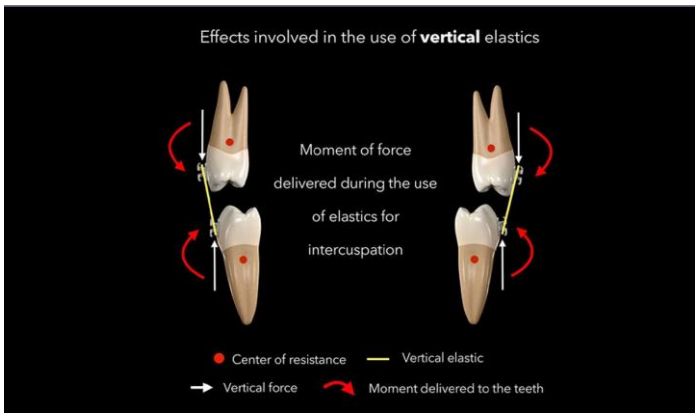


Figure 27: Effect of vertical elastic Pozza 2021

1.4.3.2 Class I, Class II or Class III (unilateral posterior).

Another side effect, when used unilaterally, may be the inclination of the occlusal plane (roll axis), which may be accompanied by lateral flattening of the arch and deviation of the midlines.

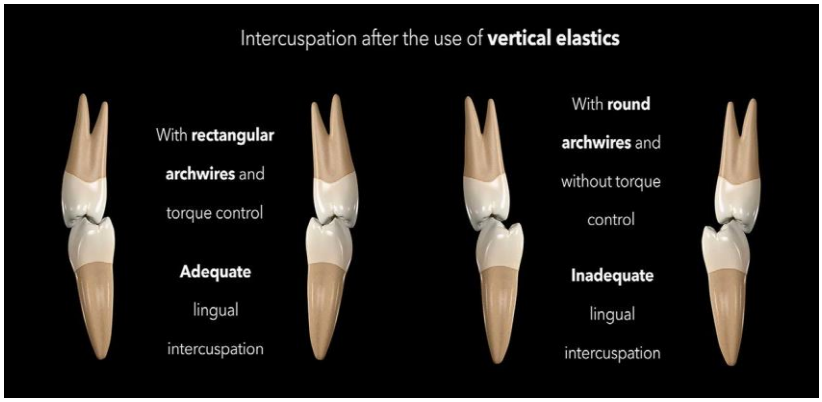


Figure 28: intercuspation after the use of vertical elastic Pozza2021

Illustration demonstrating the intercuspation performed with vertical elastic and rectangular wires, with torque control, promoting correct buccal and lingual contacts at the end of the treatment; and the intercuspation performed with vertical elastic and round wires, promoting torque change and lack of contact in the lingual region after treatment.

Vertical elastics will cause canting of the occlusal plane unless the force passes through the CR. When placed off-center they can produce an open bite on the other side.

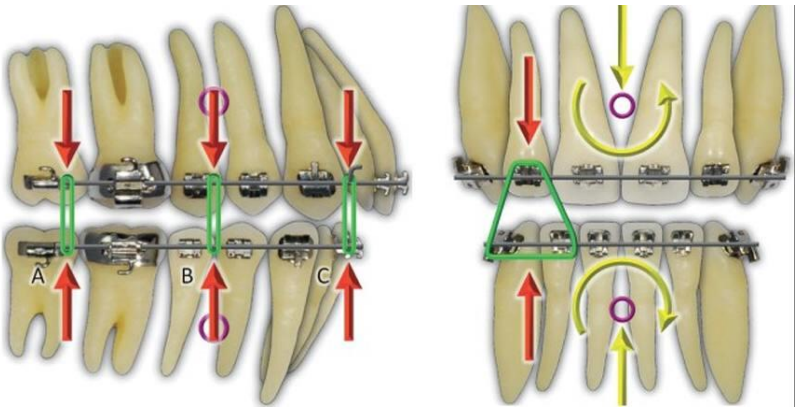


Figure29: Direction of force in vertical elastic(choy2011)

It would be difficult to get the patient's compliance to wear so many elastics. All elastics can be replaced with an equivalent single elastic.

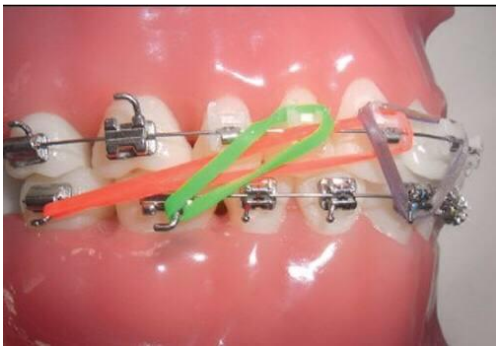


Figure 30: vertical elastic(pithon2010)

This up-and-down woven elastic is placed to close a posterior lateral open bite. The required force can be gained from a single force far posteriorly as possible.

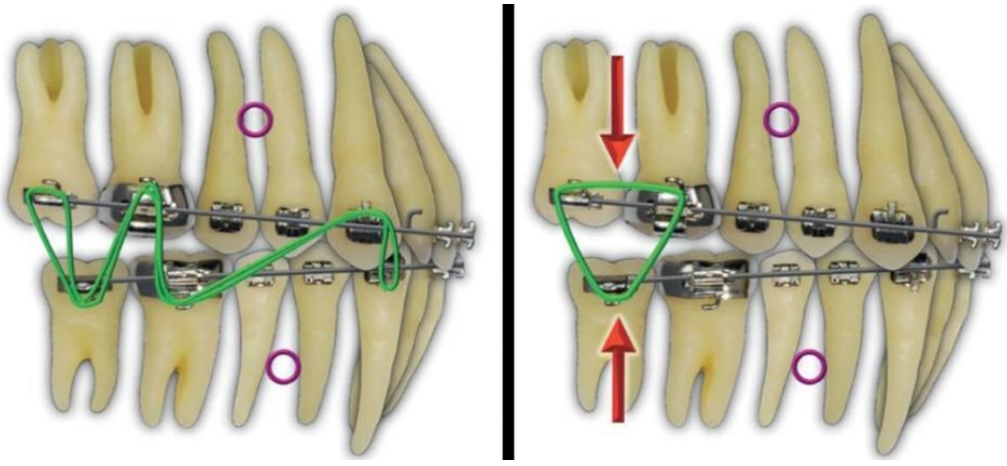


Figure 31: up-and-down woven elastic Almeida 2020

This up-and-down elastic is poorly designed because a single elastic (green) placed as far anteriorly as possible would close the anterior open bite more efficiently.

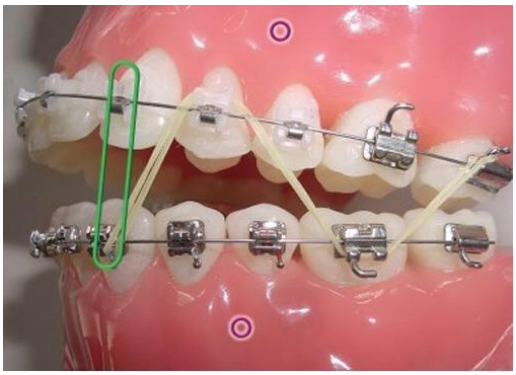


Figure 32: up and down elastic with single elastic(green) Kersey2007

1.4.3.3 Anterior vertical elastic

In the anterior region, direct elastic materials can be used when the open bite needs to be closed by lengthening the upper and lower teeth. Due to the direct load on the front teeth, there is an increased risk of root recurrence, its use is recommended only for adding and closing small front teeth with a maximum of 2 mm.

Maxillary and mandibular structures move in opposite directions, leading to increased overbite. Most of the rotation occurs in the maxillary arch.

The long horizontal portion of box elastics could irritate the gingiva, and the horizontal portion of the elastic force produces unnecessary mesiodistal forces that could potentially rotate the attached teeth. This elastic could be replaced with a smaller simpler form. Anthony and viazi 1993

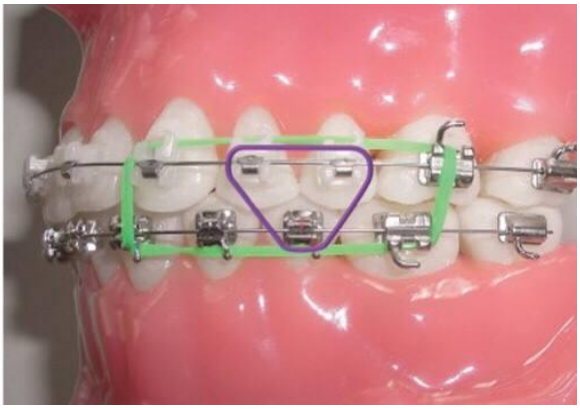


Figure 33: Anterior vertical elastic(Miura 2007)

1.4.3.4 Unilateral Vertical Elastics

It is possible to use the vertical elastics unilaterally. However, elastics can only be used in this way when one really wants to correct inclination of the occlusal plane with extrusion of one or both arches on one side, as this will certainly be an expected effect in this configuration of use.Mitchell 2013



Figure 34 :Patient treated with 3/8-in vertical elastics of light force in the anterior region, to improve the overbite. Mitchell 201

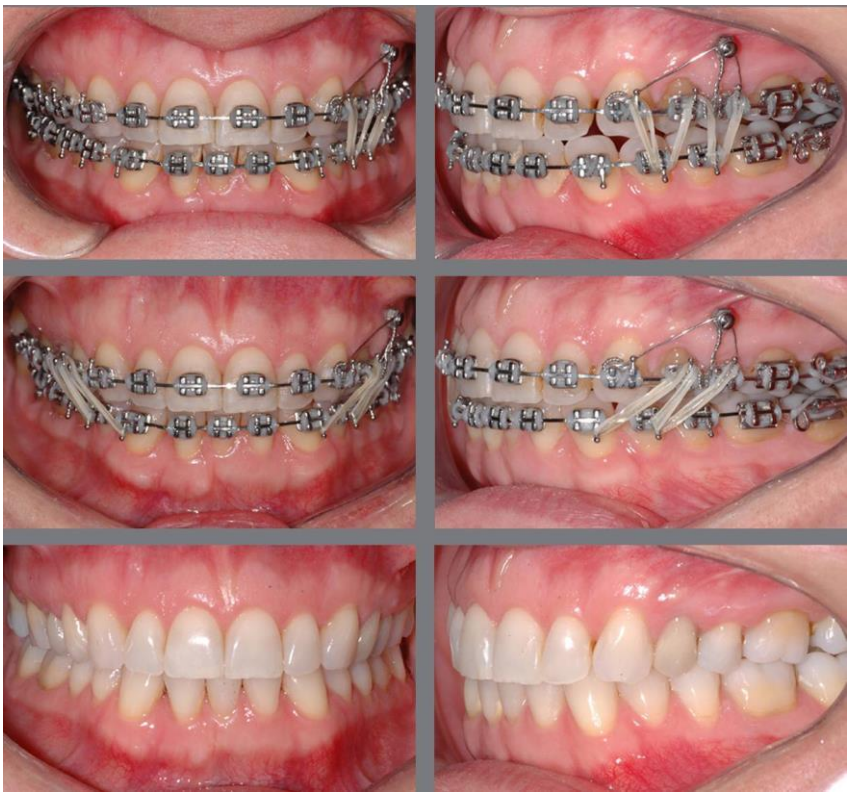


Figure 35: Patient treated with 3/8-in vertical elastics of light force in a W-shape, for unilateral extrusion, after correction of the cant of the upper occlusal plane with

intrusion supported by a miniscrew. Mitchell 2013

1.5 Intermaxillary Elastic with Clear Aligner.

Intermaxillary elastic is also used organically with a clear aligner, which is a very important tool in correcting sagittal, vertical and transverse problems. Some studies have shown a limited number of corrections with arc movements. In these cases, it is therefore recommended to use a higher strength for intermaxillary elastics or to use elastics as a means of fixation in the dispersal of successive organisms, with or without a skeleton. Lombardo L, Colonna A,2012



Figure 36: INTERMAXILLARY ELASTICS WITH CLEAR ALIGNERS Eliades 2016

CONNECTION

The connection of intermaxillary elastics with the aligners can be performed in different ways, depending on the necessity in the biomechanics and preference of the professional. For elastics with Class II or Class III anteroposterior components, the connection can be made by means of precision cuts in the aligners, buttons bonded directly to the teeth or even in resin hooks, normally positioned in the regions of first molars and canines.

In the posterior connection, the use of buttons bonded to first molars is recommended, as the aligners have little resistance at the ends, not being able to control the side effects of the elastics on the second molars

In the anterior region, the aligners present greater stability to displacement, due to the use

of anteroposterior elastics. Therefore, the connection in this region can be performed directly over the precision cuts in the aligners; however, the use of attachments positioned on the canines or over the adjacent teeth is suggested to increase retention and avoid any displacement of the aligners. Schupp W, Haubrich J, Neumann I 2006

Size, Force, And Wear Time: With the necessity for anteroposterior effect (Class II and Class III), smaller elastic band than the one used with the fixed appliance must be used, because in the case of aligners the connection is in the region of the first molar and canine; there-fore, with a smaller distance between the connection points. In these cases, a 3/16-in medium-strength or heavy-strength elastic is usually used.

For crossbite, the 1/8-in elastic band of medium strength is recommended; and for vertical improvements, the same elastics used with the fixed appliance are recommended, with the size, direction and force depending on each occlusal situation, as in fixed mechanics. Mapare2016



Figure 37 : Intermaxillary elastics with anteroposterior direction with clear aligners, with posterior connection made with bonded buttons and anterior connection made direct to precision cuts in the aligners. Greenberg 2014

Side Effects: The side effects involved in biomechanics with aligners are similar to those seen with fixed appliances.

Root Resorption: It most commonly occurs in association with the use of Class ll, vertical elastics, or central elastics on the anterior teeth. This is because the constant strength and elasticity of these teeth are inherently combined with short periods of suspension and daily

movement (back and forth) during removal and replacement of elastic. Therefore, the use of intermaxillary elastics should be avoided in patients with a history of root resorption or loss of bone support Turjanmaa1994

Allergic Reactions

Approximately 3% to 17% of the population has some degree of latex allergy, which can lead to stomatitis, edema, mouth sores, and respiratory problems. For these problems, it is recommended to use elastic made of latex-free silicone, sold by some orthodontic product brands Langlade 2000

Tooth Mobility

The emergence of relative function when using intermaxillary elastics can be considered normal, especially when vertical elastics are used. This is due to swelling of the alveoli and resulting tooth extraction of the alveoli. During retention, the tooth usually returns to its final position. Sobral2013

The use of elastic should be avoided in teeth with a history of movement due to periodontal disease and loss of bone support to prevent serious wear and tear on these teeth.

Joint Or Muscle Pain

Some patients experience joint or muscle pain when using intermaxillary braces, especially elastics, which distribute asymmetrical forces in the arches, resulting in unequal force effects on the two sides of the muscles and joints.-temporarily.7,14 In these cases, if the pain is mild or moderate, it can usually be resolved by reducing the time of use of the tire in the first days and gradually increasing until the end of the period is reached. Bratu 2004

Chapter Two

Discussion

2.1 Discussion

There is no doubt about the importance of intermaxillary elastics in orthodontic treatments, due to their wide versatil-ity and possibility of biomechanical application. However, it is important to have a deep knowledge of the desired effects and of the possible side effects that are normally associated with mechanics using elastics, so that the results are obtained as desired and planned by the orthodontist.

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