In-Ovation® R & C Interactive Self-Ligating Orthodontic Brackets

Low Friction Self-Ligating Brackets with High Prescription Control

White Paper by
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Dentsply Sirona Orthodontics

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Dr. Núñez graduated from the University of the Eastern Republic of Uruguay in 1996. He taught as an assistant professor at the Orthodontic and Dento-facial Orthopaedic Department at the same University for 10 years. He has taken several postgraduate courses at UDELAR, given by instructors within the Orthodontics Department and visiting faculty. He completed the CCO 1 Uruguay course at the Roth Williams Center for functional occlusion, given by Drs. Ronald Roth, Robert Williams, Anka Sapunar, and national instructors. He is currently Director of the Dentsply GAC International Continuous Orthodontics Education Program for Latin America. He is a member of the Uruguayan Dental Association, the Latin American Orthodontists Association, and the World Federation of Orthodontists. He has given numerous conferences and short courses at the national and international levels. He owns a private practice in Montevideo, Uruguay.

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Introduction

Since the beginning of the edgewise archwire technique in 1915 Dr. Angle designed a bracket with a pin going through the gingival and incisal flange, thus closing the slot. A few years later, in the 1930's, a bracket designed by Dr. Stolzemberg was released, and new designs followed in the 1970's, however they were not popular due to lack of clinical and commercial success. The self-ligating brackets boom surged again in the 1990's with the appearance of Time in 1994, Damon SL in 1996, and Twinlock in 1998.

It could be said that this time self-ligating brackets became another of the big advances or paradigms of our discipline. Self-ligation is typically categorized into two types, passive or interactive. Some believe in a third category (active), by in my opinion, interactive more appropriately represents this category. Passive brackets are those in which the closing clip never pressurizes or pushes the archwire towards the end of the slot; the clip may be rigid or flexible. Interactive brackets utilize clips that are able to flex and interact with archwires to correct the teeth's position. The clip on an interactive bracket fits inside the slot and pushes the archwires towards the base of the slot.

In-Ovation R

In-Ovation R (reduced size) surged in 2002. Designed by Dr. John Voudouris with the help of Dr. Ron Roth*, it is a True Straight Wire twin bracket with a cobalt chromium interactive clip that turns it into a self-ligating bracket. In order to really be a Straight Wire bracket, it must be prepared via MIM or molten metal. This allows for all required attributes of a True Straight Wire bracket to be present:

- Compound Contour Base (mesial-distal and gingival-occlusal contours)
- Torque in base (not in the slot)
- Proper in/out and anti-rotation
- Level slot alignment at the conclusion of appliance therapy

Characteristics:

- CO-CR metallic clip Twin bracket, able to twist and interact with the archwire
- MIM manufactured
- Torque in base
- .022"x.028" or .018"x.025" slot
- Base Rx* prescription and many more
- It is BioInteractive
- Single mesh base
- Identification on the base and distal gingival wing
- Laser welded hooks
- Excellent surface finish

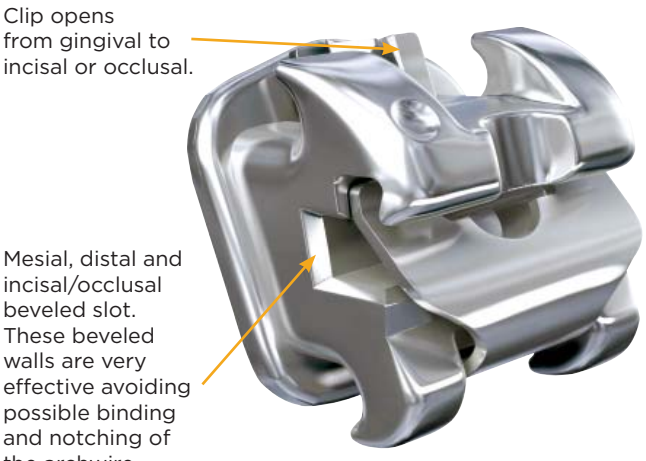
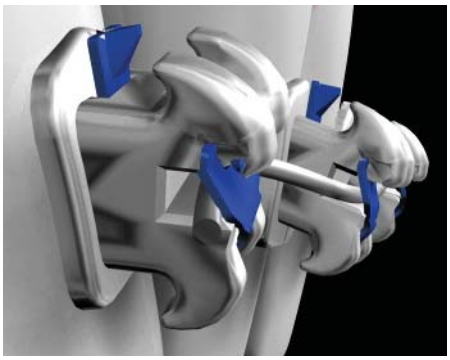


Fig. 1: In-Ovation R

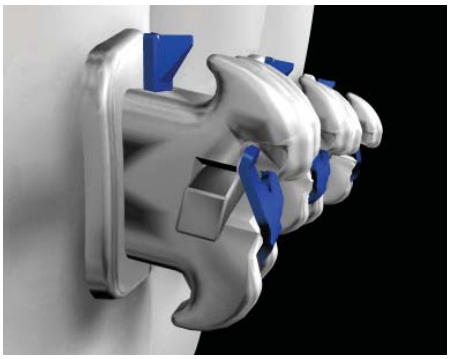
Fig. 2: In-Ovation R

*Dentsply Sirona Orthodontics Base Rx has prescription values that are equivalent to the Roth prescription. ROTH is a registered trademark of Roth Licensing, LLC.

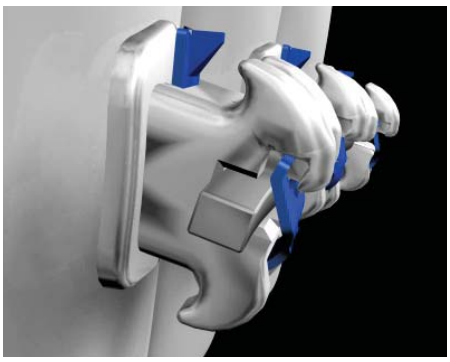
Fig. 3: In-Ovation R



PASSIVE



EXPRESSIVE



ACTIVE

Fig. 4: In-Ovation C

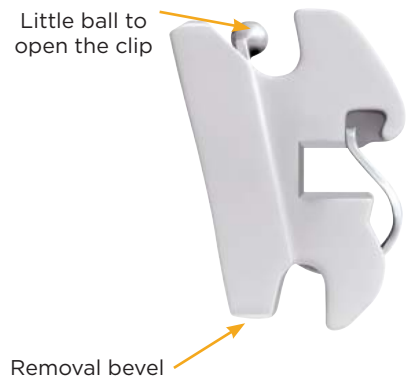


Fig. 3 - In this view it is possible to see the torque in base of In-Ovation R. This type of torque is extremely important for the self-ligating brackets considering that once leveled and aligned the slots must be parallel with the other slots without difference in angulations.

It shows the functioning of the bracket and clip in different archwire sections. From left to right we see passive, expressive and active. These images clearly illustrate why it is referred to as interactive technology. The clip conforms (interacts) to different shapes and sizes of the archwire, tooth position, and moment in treatment.

Opening and closing the clip on In-Ovation R brackets requires a simple gingival to occlusal motion. There are a number of instruments available to open a clip. My preference is the Engage-R.

The clip opens easily when pressure is applied occlusally to the V notched clip at the gingival side of the bracket, using the Engage-R or similar instrument.

If unable to access the gingival V notched clip you can also utilize the Opin-R notch on the facial surface of the clip by applying gentle pressure occlusally with a mini scaler.

The clip can be closed with an instrument, or simple finger pressure on the incisal curve.

The primary method for opening and closing the clip is the V notched clip.

In-Ovation C

In-Ovation C is an Injection Molded (IM) produced polycrystalline ceramic twin bracket. It is translucent, thus enabling blending with the tooth color on which it is attached. (Fig. 4)

Characteristics:

- Torque-in-base, compound contour base
- Rhodium covered cobalt chromium clip that makes the metal shine whitish and opaque
- 100% mechanical macro-retention base at the sides and a frame on all the peripheral that goes over the tooth, preventing marginal infiltration and facilitating removal. It has no silane.
- Mesial and distal rounded hooks that make the bracket more resistant
- Tooth specific colorimetric Ovation identification
- Mesial, distal and incisal beveled slot just like in In-Ovation R

At the end of 2007, superelastic Sentalloy® and BioForce® rhodium-covered archwires were launched in the market. These, just like In-Ovation C clips, are whitish and opaque, preventing light reflection and boosting aesthetics. They are called Sentalloy and BioForce High Esthetic. These archwires offer big advantage over conventional aesthetics with epoxy resin or Teflon cover as they are not changed by buccal conditions.

To remove this ceramic bracket, the ODG-346 RT plier is recommended. To use, place the debonding instrument in the debonding channels, occlusal gingivally and squeeze. Torquing of bracket is not indicated in debonding procedure. (Fig. 5)

The sharp pliers' edges will thus be placed at the tooth-bracket interface, having previously removed excess resin with a multi-edge drill. Tweezers can be placed in mesio-distal, gingival–occlusal, or diagonal direction, as it suits the professional.

Clinical Suggestions:

- The necessary composite to attach these metallic single mesh or ceramic brackets must be orthodontic, in other words, it must have adequate consistency and fluency to penetrate the retention and at the same time allow placing the bracket on the face of the tooth without sliding. GAC recommends NeoBond® by GAC.
- Bond the In-Ovation R brackets with the clip closed. This way, 3 references should coincide with the tooth longitudinal axis; the gingival notch of the clip, the vertical line at the gingival part of the base and the vertical line at the incisal part of the base. In-Ovation C brackets can be attached with the clip opened in order to rely on the colored rubber bar references in the slots and make for more accurate placement.
- Avoid excess composite to the gingival and incisal so as not to impede the opening of the clip.
- Once attached, it is not recommended to open with an explorer from the face of the clip because it can be permanently deformed if the force is excessive. This method should be reserved for cases only where the notch is inaccessible due to gingival inflammation.
- Ensure the wire is properly seated in the slot before closing the clip.
- Like all self-ligating brackets, its action will be limited if the patient does not maintain good oral hygiene. Scaling or etching may be utilized to clear up clip functionality in these cases.

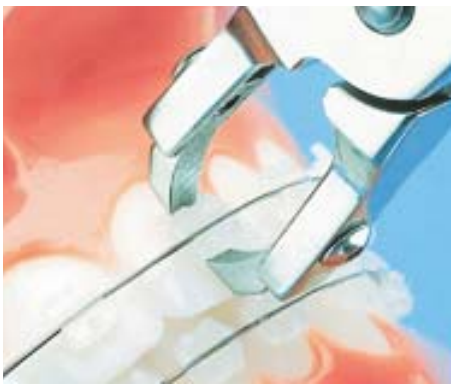


Fig. 5

Concepts of Friction and Archwires Used

When talking about self-ligating brackets we immediately think of the low archwire sliding resistance inside the slot. Thus they have low archwire - bracket friction coefficient which provides many treatment advantages. Friction reduction is enabled by three factors: alloys that integrate brackets and archwires, the lack of need for elastomeric or steel ligatures, and a more gentle archwire path when there is overcrowding without causing permanent deformity and greater inter bracket distance that may act in favor or against as we shall see.

Each of these factors deserves to be studied in depth. When we speak of alloys that integrate the bracket and archwire, we know that the lower friction coefficient occurs between two good quality steel alloys. In-Ovation R and C clips are both made from cobalt chromium. These are more flexible alloys than the 18-8 conventional steel archwires, that allow flexing for displacement towards the outside in the case of a lingualized teeth for example, transversally flexing in rotation cases and allowing deformation in different shapes depending on teeth malposition. The clips that participate in the correction of dental malpositions tend to pull the archwire towards the slot end while the arch tends to escape from it in order to recover its initial austenitic shape and thus both opposite forces and synergic action correct overcrowding. IT IS TRUE that in being a clip that participates in correction, it slightly increases friction with the archwire, being this much lower than that of conventional brackets ligated with elastomer, BUT always maintaining tridimensional control

of the tooth on the bone, unlike passive brackets that have less friction and also less control.

With regards to elastomers, these, depending on quality, lose elasticity at between 10 and 20 days and are colonized by bacterial plaque as days go by. In order to solve the elastic ligature loss of tension, they can be ligated as 8 instead of in a circle, which increases friction even more, as seen in Fig. 6. Being tight to start with, they press the archwire against the slot and considerably increase sliding resistance, not needing this auxiliary, by itself is a big advantage. (Fig. 7a) The elastomeric ligation, and even more so the metallic ligation, can cause permanent archwire deformation in severe overcrowding cases due to exceeding alloy elastic limit. With the use of In-Ovation R and C, this problem does not occur because the clips deform flex, allowing the archwire path to be less crooked. (Fig. 7b)

A bracket's mesio-distal width must be at most half of the tooth's width. Narrow brackets generate less friction due to the smaller slot path, but compromise the sliding mechanism, the tip and rotations control. Therefore, in the apparatus selection for your patients you should consider width since a narrow bracket may cause deficiencies. In-Ovation R is a small twin bracket that, thanks to its interactive clip, helps eliminate these problems, providing very good tridimensional control. According to several studies, the In-Ovation R clip has shown to have the most success in settling the arch compared to other similar brackets. (Studies by Dr. Nobrega, São Pablo, Brazil)

Distance between brackets is another one of the previously mentioned elements that can reduce the force transmitted to the teeth. With the archwire span being bigger between brackets, it will cause more flexibility and will decrease the force intensity. BUT in cases of very badly placed teeth on the bone, with a more narrow bracket, the arch deflection inside the slot will be bigger and the bracket slot edges will be in more intense contact with the arch (binding and/or notching), thus increasing friction and eventually the force to be transferred. (Fig. 8)

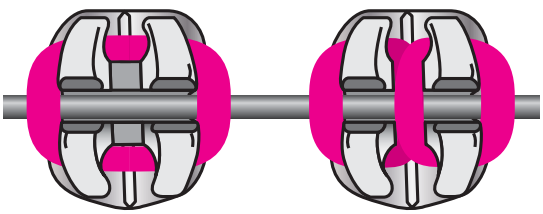
Another of the interesting attributes of self-ligating brackets is the reduction in treatment length. In order to enjoy this advantage the clinician must acknowledge the bracket attributes, the prescription it uses and the sequence of arches to be used. It is a fact that small and constant forces are more physiological, reabsorption in pressure areas will be direct or frontal and dental movements will be faster and more physiological.

Since it is not necessary to frequently change elastomers, appointment intervals can be extended. If the Orthodontist has established a certain treatment plan in accordance with a correct diagnosis, patients can be seen in fewer overall appointments, booking visits every 8 weeks on average. In-Ovation R and C are best utilized when given the opportunity to work over time. It is important to allow adequate time for each archwire and for the whole prescription to work.

Archwires Used

Regarding archwires, most orthodontists use as the last archwire, a .019"x.025" in

Fig. 6: Conventional and eight ligation.



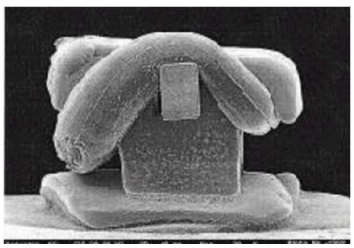


Photo by Dr. Celestino Nobrega

Fig. 7a: Conventional ligation

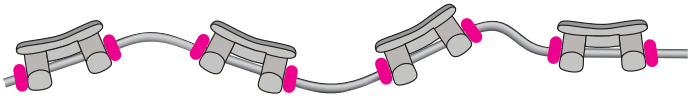


Fig. 7b: Interactive self ligating bracket

Fig. 8

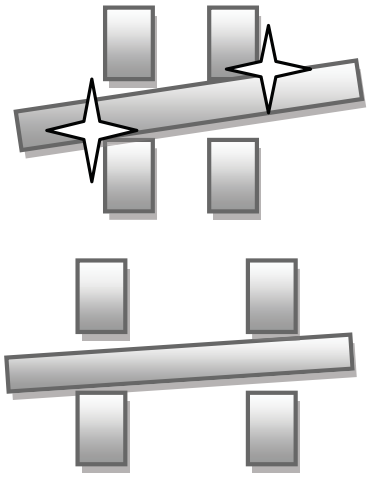


Fig. 9

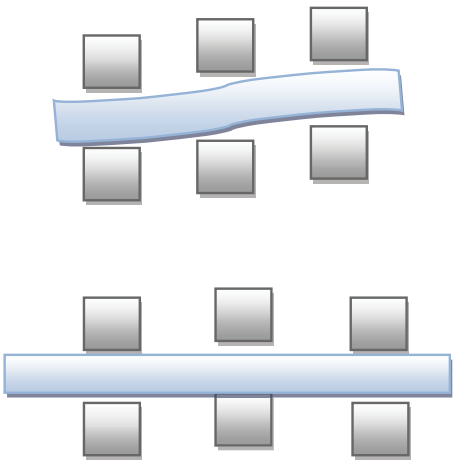
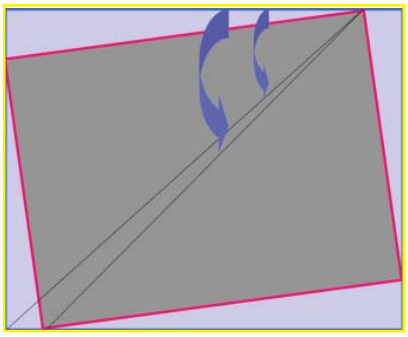
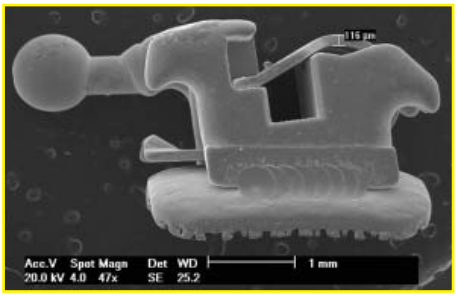


Fig. 10



.019"x.025" archwire in .022"x.028" slot



Provided by Dr. Celestino Nobrega

Fig. 11

.022"x.018" BioForce archwire.

.022"x.028" bracket, which is why the prescription cannot be fulfilled. Drs. Andrews and Roth always sustained the importance of utilizing full size archwires in order to fully benefit from the appliance. It is a fact that the better the dental positions achieved the better the post treatment stability.

Not only the torque is insufficient when finishing with smaller archwires at slots in passive brackets but so are the tip, the in & out, leveling and alignment as shown in Fig. 9. Many colleagues maintain that when finishing with these full size archwires, even the smallest bracket placement errors exposed, therefore needing repositioning. This is why it is critical to take the time up front to make sure brackets are precisely placed and positioning is accurate.

Passive self-ligating systems had to develop special dimension archwires to work, considering that since there is always a certain play between archwires and brackets, it is very difficult to achieve correct dental positions. Measurements like .016"x.022" had to be replaced by .016"x.025", in order to have bigger depth in the slot, with .002" still remaining to be filled. Studies made by NYU (New York University), found that a .019"x.025" archwire in a .022"x.027" slot with passive clip, creates a 7.2° angle (Fig. 10). This angle is even bigger if the archwire edges are rounded, as manufactured by various companies for the archwire insertion to be easier.

The main concept of passive systems with heat activated archwires is to move teeth with small forces and place them in a neutral zone, between the buccal forces and the tongue force in accordance with concepts developed many years ago by Dr. Frankel. In order to reduce forces there needs to be that play between the bracket and the archwire. This is also why higher torques are utilized in passive systems; in order to correct the different malocclusions, thus solving the archwires inability to fill the slots and fully express the prescription.

This does not occur with interactive clips brackets like In-Ovation R and C since once the archwire exceeds .0185" depth, the clip settles it towards the slot end to finish leveling alignment and providing more torque. As we keep advancing on the archwire sequence, we can use an archwire like the .022"x.018" BioForce, designed exclusively for In-Ovation R and C in order to vertically fill the slot and not be touched by the clip. With this archwire we advance in the treatment, taking advantage of the low archwire-bracket friction. (Fig. 11)

When arriving to the final archwires like .021"x.025" or .0215"x.028", all alterations have been corrected in the three space directions. In this

delicate termination stage friction is a determining factor for the archwires to remain in place, work, and fulfill the chosen prescription. **In other words, this interactive bracket system benefits from the archwire-bracket friction to fulfill the prescription, unlike passive systems.**

For every particular case and depending on various elements like biotype, malocclusion, periodontal biotype, the presence or absence of temporomandibular dysfunctions, periodontal health etc., the archwire's sequence will be determined. At the end of this white paper you will find, some possible archwire's sequences divided according to malocclusions and to my concepts. Remember these charts are only a guide for the reader and not an absolute or unchangeable way of treating your patients.

Sentalloy®

The name "Super Elastic Nickel Titanium Alloy", means exactly what it states. They are the latest NiTi archwires generation. Unlike conventional NiTi they have a memory shape that is activated with the presence of buccal stress and temperature, about 37.5ºC/98.6ºF. Its initial Austenitic phase is characterized by the presence of cubical alloy crystals and striking clinical malleability that increases when the archwire is cooled down. When inserting these archwires in brackets, the alloy changes to martensitic stage with hexagonally shaped crystals which under higher temperature start recovering their initial shape with low and practically constant forces, correcting the teeth positions.

BioForce is a unique archwire in the market. It is a square or rectangular Neo Sentalloy with sectorial heat treatment that as a result produces an archwire with three different forces depending on the archwire region. Like its name insinuates, it provides the ideal biological force for each dental group. In the front sector it releases light force for the incisors group, intermediate force for the canines and bicuspids and heavier load for the molars.

BioForce provides leveling, alignment, rotation correction, and at the same time, it provides torque, tip and in & out since it comes only in quadrangular and rectangular sections. It is an archwire that simplifies the overall archwire sequence. It behaves like three different arches according to the sector, at the front it finishes leveling, aligning etc. and in lateral and back sectors prepares anchorage, expressing the distal offset of molars and premolars.

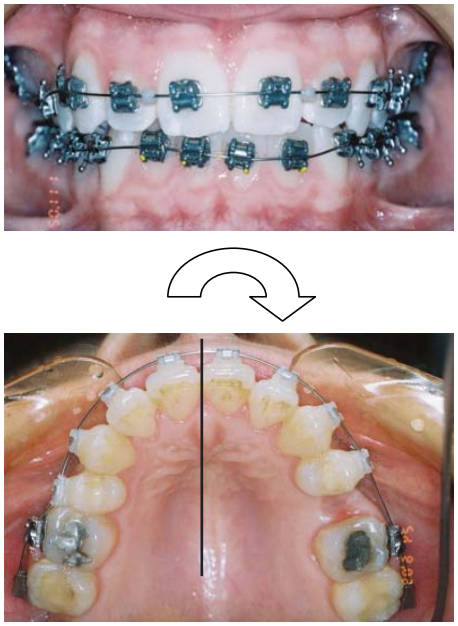
In-Ovation R and C interaction with these archwires ensures low forces, less disturbance, faster movement and correct use of the system's advantages.

Friction

This element's management is essential for self-ligating brackets. Depending on the movements you want to make, it is possible to set a sequence for them to be carried out. In most cases and especially in patients with well toned or high toned peribuccal musculature we know that the initial archwires force (like that of .014" Sentalloy) will not exceed the lips pressure. In these types of patients you can expect frontal overcrowding correction and archwire distal sliding without the anchorage becoming loose. The ample space that these first archwires count within the slots facilitates distal sliding of these last.

One of Base Rx* prescription characteristics is the cortical anchorage at molars and premolars level through distal offset incorporated in molar tubes and premolars' brackets. In cases of frontal overcrowding and bicuspids extraction, once the appliance is installed and all teeth are ligated, each of them will be distally placed through the reciprocal forces applied on the neighbors, thus closing the extraction space without need for canines' retroligation or lace backs. When archwires are used

Fig. 12: In-Ovation R



Low friction causes the force transmitted to the tooth to be smaller. The use of super elastic arches also works to release small and practically constant forces. These two factors cause dental movement to be more physiological, the force moment exercised in each case to be smaller, osseous reabsorption to be frontal, and dental sliding to be faster with fewer inclinations.

in good timing and shape there should be no loss of anchorage, nor anterior sector protrusion.

In the case of a Class II 2nd division with big incisors' verticalization we must manage friction differently. Ligating premolars with elastomers or placing crimpable stops or composite caps on the archwire prevents this archwire's distal sliding due to which, all its energy will be used on the front sector and the incisors group will turn vestibular. Something similar can be implemented in Class III cases for dental malpositions (not skeletal).

Differential friction is also very useful for deviant dental midlines. We block the archwire slide on the deviation side and allow the archwire to work on the side we want the mid line to move to. When every archwire, even if rectangular, exhausts its working capacity, it will transversally slide inside the slots, appearing at one or other molar tubes distal, lacerating the patient's cheek. This is the time to advance the archwire. For this reason it is important to place crimpable stops or composite caps on archwires that will stop them sliding from side to side without interfering with overcrowding correction and spaces management.

Anchorage

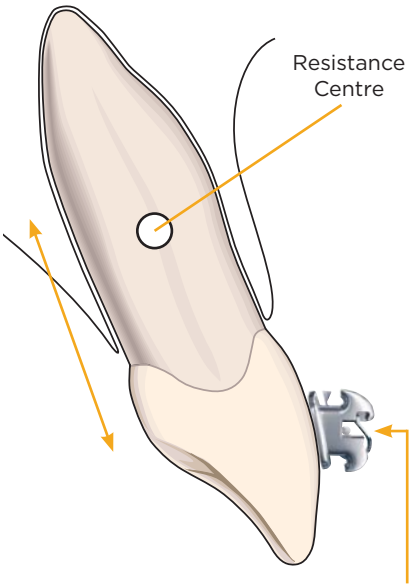
Anchorage is provided by those anatomic structures that are opposed to orthodontic movements. Using conventional brackets with elastic ligatures increases archwire-bracket friction too much, which is why higher forces should be used to move teeth, that may lead to defeating the anchorage capacity of the pieces in which we anchor and suffer unwanted movements.

Unlike conventional brackets, with self-ligating brackets the archwire-bracket friction coefficient is much smaller, which is why the forces to move teeth do not need to be so high. Since the forces to be used are smaller, not so many auxiliary elements or procedures will be needed to strengthen the anchorage.

The use of Sentalloy coil springs is recommended for the closure of spaces after extractions. Being manufactured with different loads, we know with what force we are working, unlike what happens with elastic chains. In these cases is recommended the use of 150 to 200 gr. coil springs, depending on the patient's anatomic characteristics.

The use of micro implants, mini screws, ortho implants, TADs, etc. is very useful when combined with self ligating brackets. We know that these devices provide what is considered absolute anchorage since they will not move at the application of force. Through them it is possible to intrude, extrude, verticalize, re-enforce anchorage, help space closure and many more applications.

Fig. 13



Force application point.
A force moment is produced.

Fig. 14

Sentalloy coils mini screws

Molar Sentalloy coil spring

Elastic chain mini screw

Canine Sentalloy coil spring

CLINICAL CASE

Diagnostic - Male patient, 30 years old with straight retracted profile, Class I skeletal and Mesofacial Biotype. In maximum intercuspation shows Class I molar and canine and on the way to centric occlusion shows contacts between 17 and 47. Increased overbite, verticalization of central incisors (153.9° interincisor angle) and 8mm lower cramming.

Quadrangular dental arches with lateral sectors compression and light Bolton discrepancy in favor of lower sectors, showing upper lateral incisors with microdontia. Occlusal plane fallen to the right.

Treatment plan

1. Aligning, leveling and derotating.
2. Preparing prescription anchorage, dental arches conformation and applying torque to the front sectors.
3. Coordinating archwires among them.
4. Achieving the best occlusal adjustment with the apparatus. Occlusal equilibration after appliance removal.

Summary of Arches Used:

.014" Sentalloy,
.018" x .018" BioForce,
.019" x .025" Neo Sentalloy,
.021" x .025" Neo Sentalloy,
.0215" x .028" Neo Sentalloy,
.021" x .025" & .021" x .025" braided.

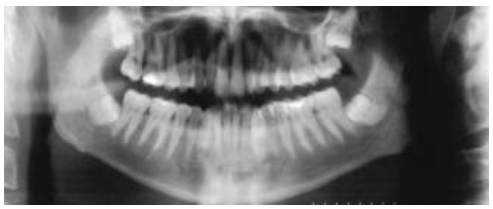
All objectives planned at the start of the treatment were fulfilled in this patient. The change in the soft tissue is notable at the lips level, after correcting dental malpositions.









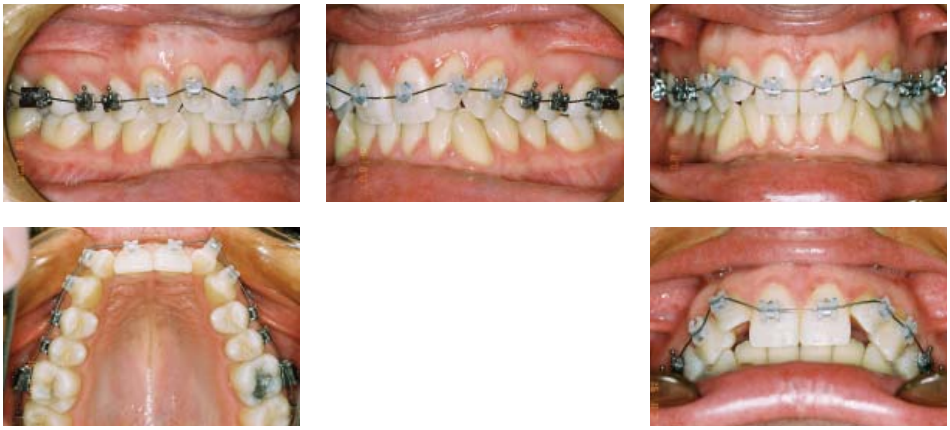




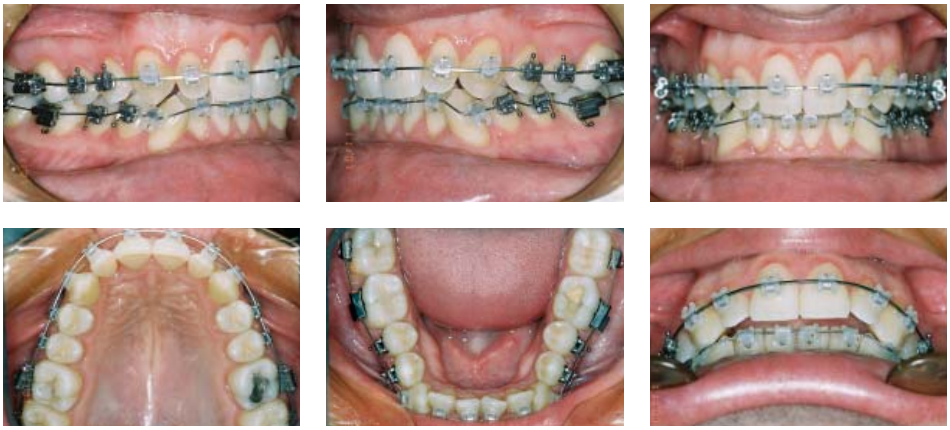




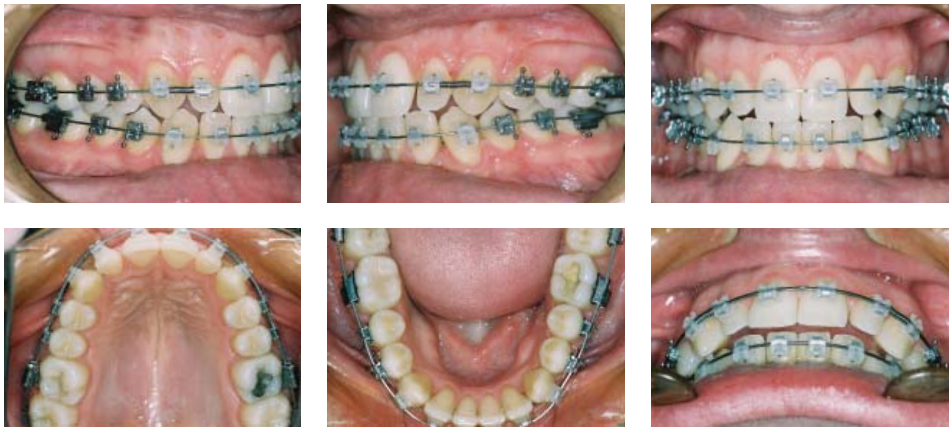
Treatment Evolution



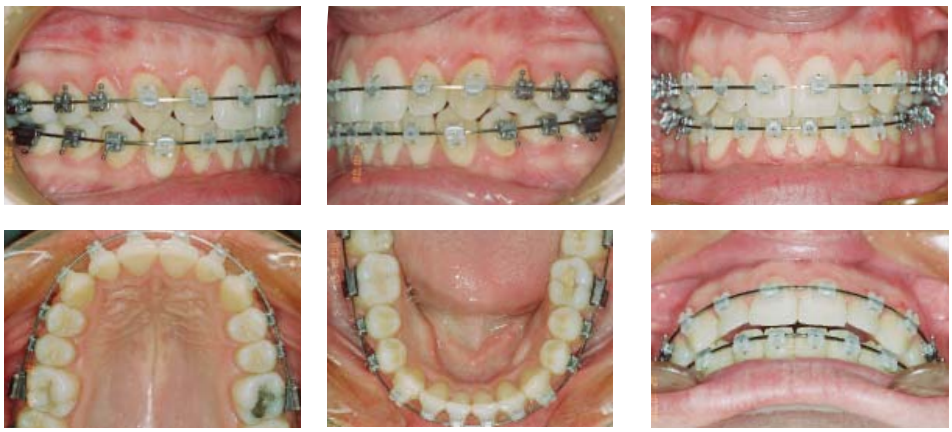
.014” 8 weeks upper Sentalloy archwire until correcting incisors position and being able to place lower ceramic brackets.



.018”x.018” BioForce upper archwire and .014” lower Sentalloy archwire with elastomers at the 2nds. Lower premolars, preventing the archwire to distally slide and work more on the front sector, providing positive torque to verticalized incisors.



.0215”x .028” Neo Sentalloy upper Arch with Sentalloy coils compressed at the distal of laterals to reconstruct and solve inter arch dental discrepancy and .019”x.025 Neo Sentalloy lower archwire to continue lower arch leveling. Up to now no elastics, nor lacebacks ligatures have been used on the canines.



.021”x .025” upper and lower steel archwires to finish settling the teeth in their places in alveolar processes. Afterwards, braided upper and lower multifibre steel archwires of the same caliber and 1/8” 6 oz intermaxillary elastics are used for 8 to 12 weeks to achieve occlusal settling and transition toward removal.

Conclusions

In-Ovation R and C two interactive, self-ligating brackets that integrate with advanced archwires resulting in a system that ensures a very low archwire-bracket friction coefficient with very good tridimensional tooth control.

If you are currently using the Base Rx* prescription these In-Ovation System does not change your current treatment protocol. Simply keeping in mind some of the previously mentioned suggestions, the cases will be solved faster and with less disturbance. Additionally, In-Ovation R and C do not mean having to change diagnostic method. In some cases working with these forces may stimulate (though it is not scientifically shown) new osseous formation and thus obtaining more space for overcrowding correction through expansion. But something must remain clear; it is that if dental material is proportionally bigger than the bone, the necessary extractions must be made in order not to finish the treatment with teeth outside the bone, or many other periodontal complications.

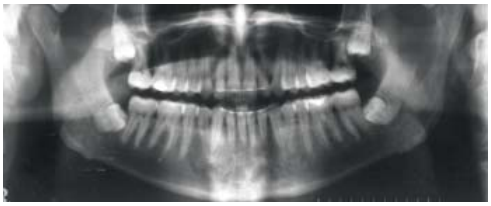
When selecting a self-ligating bracket it is important to know its working details, inter-relation with archwires, and how it must be processed in accordance with prescription.

In-Ovation R and C are two excellent products that will greatly facilitate your daily work. The time benefit you gain from longer appointment intervals can free up your schedule and change the way you practice. Whether it is using that time to accommodate extra case starts, investing more time in the marketing elements of your practice, or freeing up your schedule for more personal time, the choice is yours.



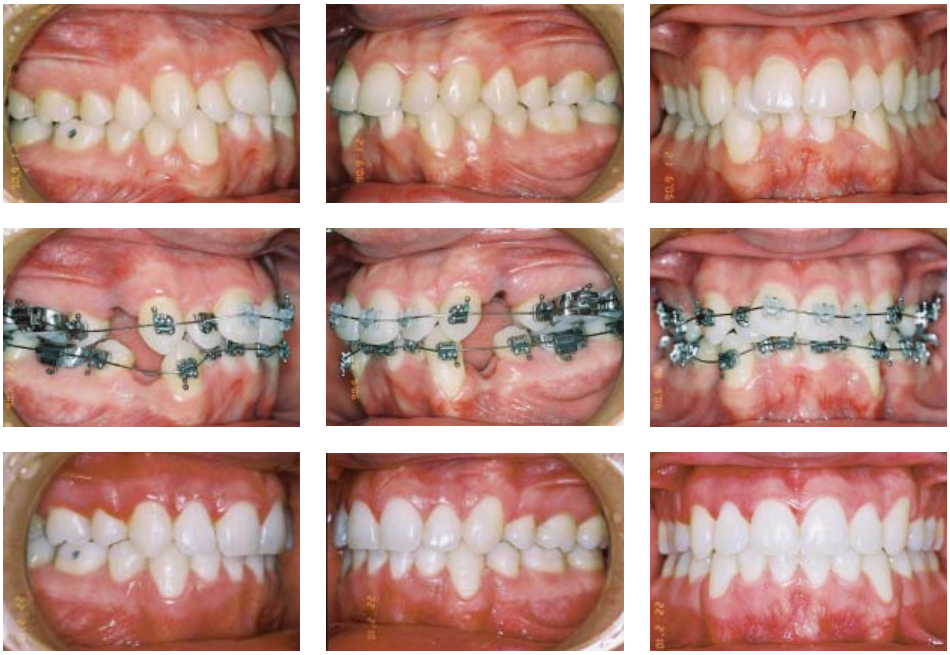
Removed appliance. Fixed upper and lower retention from the noted malposition of incisors that the patient showed.





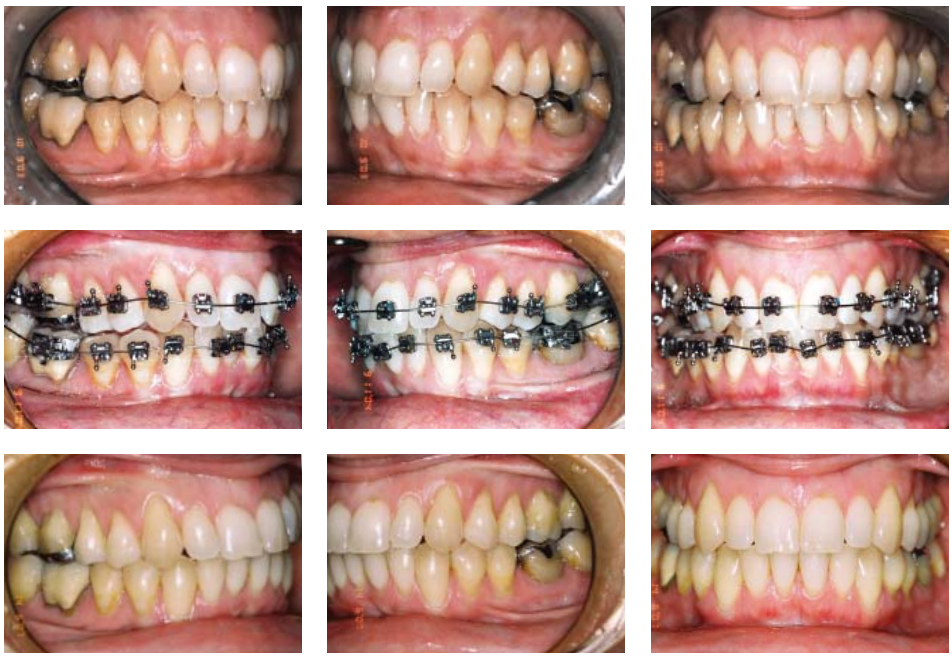






Patients treated with In-Ovation R and C

Adult male patient with a lower dentoalveolar discrepancy of 12 mm and a bi-protrusive profile. Treatment included extraction of 4 premolars and a supernumerary tooth mesial and apical to 34.



Patients treated with In-Ovation R

An adult female with periodontal alterations and temporomandibular dysfunctions. Compromise treatment without extractions and small forces..

List of Product in the In-Ovation System

		Reference
In-Ovation R Base Rx bracket set .022" with hooks on 3, 4 and 5		KIT89-055-24
In-Ovation C Base Rx bracket set .022" with hooks on 3, 4 and 5		KIT100-532-11
Sentalloy archwires .014" MD	upper	02-511-112
	lower	02-511-612
Sentalloy archwires .014" MD Hi Aesthetic	upper	02-711-112
	lower	02-711-612
Sentalloy archwires .016" MD	upper	02-511-122
	lower	02-511-622
BioForce archwires .018" x .018" MD	upper	02-528-042
	lower	02-528-542
BioForce archwires .018" x .018" MD High Aesthetic	upper	02-728-042
	lower	02-728-542
Bioforce archwires .022" x .018" MD	upper	02-528-092
	lower	02-528-592
BioForce archwires .019" x .025" MD	upper	02-528-062
	lower	02-528-562
Steel archwires .019" x .025" MD	upper	03-925-632
	lower	03-925-642
Steel archwires .021" x .025" MD	upper	03-125-632
	lower	03-125-642
Braided archwires .019" x .025" MD	upper	03-925-43
	lower	03-925-44
Braided archwires .021" x .025" MD	upper	03-125-43
	lower	03-125-44
Adhesive tubes .022" Base Rx	Upper right 1st molar	68-162-83
	Upper left 1st molar	68-262-83
	Lower right 1st molar	68-362-86
	Lower left 1st molar	68-462-86
	Upper right 2nd molar	68-172-80
	Upper left 2nd molar	68-272-80
	Lower right 2nd molar	68-372-80
	Lower left 2nd molar	68-472-80
Fiji 1/8" intermaxillary elastics 6 ounces		11-103-03

References

John C. Voudouris, DDS (Hons), DORTH, MSC. Interactive edgewise mechanisms: Form and function comparison with conventional edgewise brackets. *American Journal of Orthodontics and Dentofacial Orthopedics* Volume 111, No. 2, 119 – 140.

Textbook "Orthodontics: Current principles and Techniques. Mosby, 2005. The In-Ovation bracket for fully adjusted appliances. Ronald H. Roth, Anka Sapunar, Robert C. Franz.

Textbook "El Tratamiento Ortodóncico con Arco Recto". Drs. Jorge Gregoret, Elisa Tuber and Horacio Escobar. NM Ediciones, 2003.

John C. Voudouris, DDS. Seven clinical principles of interactive Twin Mechanisms. *Journal of Clinical Orthodontics.* Vol XXXI No. 1, 55 – 65.

Daniel J. Rinchuse, Donald J. Rinchuse, and Rupali Kapur-Wadhwa. Orthodontic appliance design. *American Journal of Orthodontics and Dentofacial Orthopedics.* Volume 131. No. 1, 76 -82.

Sandra P. Henao, BS; Robert P. Kusy, BS, MS, PhD. Evaluation of the frictional resistance of conventional and self – ligating bracket designs using standardized archwires and dental typodonts. *Angle Orthodontist,* Vol 74, No. 2, 2004, 202-211.

N.W.T. Harradine. Current products and practices. Self-ligating brackets: where are we now? *Journal of Orthodontics,* Vol 30, 2003, 262-273.

Proffit WR, Fields HW Jr. Contemporary Orthodontics. 3rd ed. St. Louis: Mosby; 2000.
Andrews LF. Six keys to normal occlusion. *Am J Orthod* 1972; 62: 296-309.

Thorstenson GA, Kusy RP. Comparison of resistance to sliding between different SL brackets with second order angulation in the dry and saliva states. *American Journal of Orthodontics and Dentofacial Orthopedics* 2002; 121: 472-82.

CLASS I WITH MODERATE CROWDING WITHOUT EXTRACTION TREATED WITH IN-OVATION R OR C WITH BASE Rx PRESCRIPTION

STAGE		ARCH TO BE USED	CLIP	GOAL	TIPS	DURATION	WARNINGS	TIME TO ADVANCE
STAGE 1								
		.012" Sentalloy			Place caps on the arch that does not			
		OPTIONAL	**PASSIVE**	Leveling, aligning and rotation.	prevent the correction of		After this period there is the risk	Once the mispositions have been corrected
Leveled and aligned	1°	.014" Sentalloy	**Or**	The initial arch section depends	crowding.	6 to 8 weeks*	of developing diastemas and losing anchorage	The arch wants to slide from side to side
			INTERACTIVE	on the skeletal biotype, periodontal health	Distal duplicity of the		especially with the arches of biggest section	Advance the sequence as soon as possible
		.016" Sentalloy		and the patient's crowding grade.	2nd Molars is not necessary.			
		OPTIONAL			Perform stripping if necessary.			
					Use differential friction			
					by placing elastomers or caps.			
STAGE 2								
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque and finishing correcting malpositions.	For deviating midlines	6 to 10 weeks*	RE-ATTACH BADLY PLACED BRACKETS	When both arches are practically
				Preparing anchorage in molars	center half of the arch with		Be careful with the inclination of the canines,	parallel and the insertion of
Arranging arches, torque				Arranging arches.	the maxillary or face midline.		these directly influence front teeth	steel arches is possible.
and anchorage					For expansion with small loads,		movement when placed	
preparation					we let them work for a longer time.		in the apparatus. The molars' position	
							dictates the correction in premolars.	
		019"x.025" Bioforce	**ACTIVE**	If unable to finish leveling and	For small crossing bites,	4 to 10 weeks		When finishing the leveling and
		OPTIONAL		aligning in braquifacial patients.	short elastics may help.		Be careful with the torque and the buccal	aligning.
							osseous base.	
STAGE 3								
	3°	019"x 025" steel	**ACTIVE**	In this stage we must finish coordinating	**INDIVIDUALIZING ARCHES**	8 to 12 weeks		
Work Stage				dental arches and correcting all	Adjustable hooks can be placed			When dental positions have been corrected
				alterations within the 3 directions of space.	in the arch to close			only settling the occlusion
		021"x025" steel	**ACTIVE**	Coordinating arches.	distemas or correct light classes II, III	8 to 12 weeks	Be careful with patients of skinny	remains.
		OPTIONAL			and deviating midlines.		periodontal biotype and/or ATM disorders	
					Remove bands and attach tubes.			
STAGE 4								
								Once the occlusion is correctly settled,
	4°	019"x025" braided	**ACTIVE**	Slowly recovering	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination				dental individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		021"x025" braided	**ACTIVE**	Occlusion settlement.	Fiji - 1/8 6 oz. Italy 5/16" Medium or	8 to 12 weeks	Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		OPTIONAL			Scandinavia 5/16" Heavy for		well sharpened pliers, in order not to fray.	time to remove the apparatus.
					deviating midlines.			

* Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.

CLASS II FIRST DIVISION WITH EXTRACTION OF UPPER PREMOLARS TREATED WITH IN-OVATION R OR C

STAGE		ARCH TO BE USED	CLIP	GOAL	TIPS	DURATION	WARNINGS	TIME TO ADVANCE
STAGE 1								
					Place caps on the arch that do not			
					prevent the correction of		Extract premolars before attaching brackets.	
		.012" Sentalloy			crowding.			
		OPTIONAL	**PASSIVE**	Leveling, aligning and rotation.	Distal duplicity of the		Attach brackets to all teeth	When the mispositions have been corrected
Leveled and aligned	1°	.014" Sentalloy	**Or**	The initial arch section depends	2nd Molars is not necessary.	6 to 8 weeks*	and pass the arch through all the brackets,	the arch will slide from side to side.
		.016" Sentalloy	**INTERACTIVE**	on the skeletal biotype, periodontal health	Retro-ligation up to the canines		in order for the reciprocal forces	Advance the sequence as soon as possible
		OPTIONAL		and the patient's crowding grade.	is not necessary.		to correct the crowding and to	
					Use differential friction		start closing the extraction	
					by placing elastomers or caps.		spaces.	
					The arch must run in distance in order to			
					correct frontal crowding.			
STAGE 2								
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque, finishing correcting malpositions and	For deviating midlines	6 to 10 weeks*	Re-attach Badly Placed Brackets	
				quickly preparing anchorage in molars for the	center half of the arch with		Do not leave this arch in the mouth long enough	
				retrusion of the front ones.	the maxillary or face midline.		to need leveling, aligning and rotation	
Arranging arches, torque					Some light elastic intermaxillary		Advance with the sequence as soon as	When both arches are practically
and anchorage					can also be used.		possible.	parallel and the insertion of
preparation								steel arches is possible.
		019"x.025" Bioforce	**ACTIVE**	If unable to finish leveling and aligning.	More load can be used if necessary	4 to 10 weeks	Do not close spaces with this arch.	
		OPTIONAL			022"x028" Bioforce,			
					019"x025" Neosentalloy or 021"x025"			
					Neosentalloy			
STAGE 3								
	3°	019"x 025" steel	**ACTIVE**	Final aligning and leveling for the sliding.	**INDIVIDUALIZING ARCHES**	4 weeks before		
				Closure of extraction spaces.	Round arches to reduce friction or	starting to	Managing the need for anchorage to choose	
Work Stage		018"X018" steel	**INTERACTIVE**	(018"x018"ss) Special for sliding teeth in the arch.	use 018"x018" steel.	close.	the closure mechanics.***	When dental positions have been corrected
		OPTIONAL		using low force.	Place adjustable hooks in the arches.		Use low friction of the apparatus.	and the extraction spaces
				Coordinating arches.	Use 150 or 200 grs. Sentalloy coils			have been closed.
		021"x025" steel	**ACTIVE**	Issuing the prescription in patients that	placed on molar	8 weeks post	Ensure the space closure with metal	
		OPTIONAL		allow using this arch caliber.	6, 7 or with miniscrew.	space closure.	ligation up to 4 weeks after closure,	
					Remove bands and attach tubes.		to allow radicular recovery.	
STAGE 4								
								Once the occlusion is correctly settled,
	4°	019"x025" braided	**ACTIVE**	Slowly recovering dental	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination				individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		021"x025" braided	**ACTIVE**	Occlusion settlement.	Fiji - 1/8 6 oz.		Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		OPTIONAL					well sharpened pliers, in order not to fray.	time to remove the apparatus.

*** Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.**

**** Steel arch 018"x018" is a very good arch for sliding. It is possible to use it after a 019"x025" steel arch.**

***** Refer to space closing methods on page 13.**

LIGHT CLASS II 2A. DIVISION WITHOUT EXTRACTIONS TREATED WITH IN-OVATION R Or C

STAGE		ARCH TO BE USED	CLIP	GOAL	TIPS	DURATION	WARNINGS	TIME TO ADVANCE
STAGE 1								
					Place caps on the arch that will **not**			
				Leveling, aligning and rotation.	allow it sliding in distance			Upon improvement of the situation of
	1°	.014" Sentalloy	**PASSIVE**	The initial arch section depends	and apply the correction		In cases of overbite it is possible	upper front teeth.
Leveled and aligned		.016" Sentalloy	**Or**	on the skeletal biotype, periodontal health	to the front sector.	6 to 8 weeks*	to place incisal caps on upper	Advance to quadrangular section arches
		OPTIONAL	**INTERACTIVE**	and the patient's crowding grade.	Do not duplicate arch in distance of the 2nd		centrals palatine.	as soon as possible in order to give torque to
					molars.		Be careful with lower ceramics brackets.	the front teeth.
				In general this malocclusion is followed				
				by overbite and **Braquifacial Biotype**.	Use the differential friction			
STAGE 2								
					For deviating midlines			
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque, finishing correction of malpositions	center half of the arch with	6 to 10 weeks*	RE-ATTACH BADLY PLACED BRACKETS	
				and preparing anchorage in molars.	the maxillary or face midline.		Be careful with the inclination of the canines,	
				Arranging arches and improving the overbite.	For expansion with small loads		these directly influence on the	
Arranging arches, torque					leave it work for longer.		front teeth movement when placed	When both arches are practically
and anchorage							in the apparatus.	parallel and the insertion of
preparation		.019"x.025" Bioforce	**ACTIVE**	In case of not being able to finish leveling and	If necessary more load can be	4 to 10 weeks*		steel arches is possible.
		OPTIONAL		aligning due to patient's Biotype.	used 022"x028" Bioforce,		The bite can be opened in the front section	
					019"x025" Neosentalloy or 021"x025"		by positive torque. Evaluate the brackets	
					Neosentalloy		positioning.	
		.019"x.025" Retranol	**ACTIVE**	Intruding frontals, reducing Spee curve, applying	It is possible to use lower reverse curve	4 to 10 weeks*		
		INFERIOR OPTIONAL		positive torque to front teeth.	arch.			
STAGE 3								
	3°	.019"x .025" steel	**ACTIVE**	Correcting all mispositions and correcting	INDIVIDUALIZING ARCHES	8 to 12 weeks		
Work Stage				class II.	Placing hooks on the arches.		Evaluate the presence of upper 3rd molars	When dental positions have been corrected
		.018"X.018" steel**	**INTERACTIVE**		Distal upper dental arch			class II and the overbite
		OPTIONAL		Coordinating arches.	with coils, miniscrews and/or		Use low friction of the apparatus.	have been corrected.
		.021"x.025" steel	**ACTIVE**		intermaxillar 1/8 or 3/16" heavy elastics.	8 to 12 weeks		
		OPTIONAL			Remove bands and attach tubes.			
STAGE 4								
								Once correctly settled the occlusion,
	4°	.019"x.025" braided	**ACTIVE**	Slowly recovering dental	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination				individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		.021"x.025" braided	**ACTIVE**	Occlusion settlement.	Fiji - 1/8 6 oz.		Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		OPTIONAL					well sharpened pliers, in order not to fray.	time to remove the apparatus

*** Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.**

**** Steel arch 018"x018", is a very good arch for sliding. It is possible to use it after a 019"x025" steel arch.**

CLASS II 2A. COMPLETE DIVISION WITH EXTRACTIONS TREATED WITH IN-OVATION R Or C

STAGE		ARCH TO BE USED	CLIP	GOAL	TIPS	DURATION	WARNINGS	TIME TO ADVANCE
STAGE 1								
					Aiming frontal correction but not			
				Leveling, aligning and rotation.	preventing distal movement of the		In cases of overbite it is possible	Upon improvement of the situation of
	1°	.014" Sentalloy	**PASSIVE**	The initial arch section depends	front teeth to close the		to place incisal caps on upper	upper front teeth.
Leveled and aligned		.016" Sentalloy	**Or**	on the skeletal biotype, periodontal health	extraction space.	6 to 8 weeks*	centrals palatine or mounting the upper	Advance to quadrangular section arches
		OPTIONAL	**INTERACTIVE**	and the patient's crowding grade.	Distal duplicity of the		apparatus and waiting the place for the bottom	as soon as possible in order to give torque to
					2nd Molars is not necessary.		apparatus.	the front teeth.
				In general this malocclusion is followed	Considering that the correction is made		Be careful with lower ceramics brackets	
				by overbite and **Braquifacial Biotype**.	class II 2a. is transformed in class II 1a.			
STAGE 2								
					For deviating midlines			
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque, finishing correction of malpositions	center half of the arch with	6 to 10 weeks*	RE-ATTACH BADLY PLACED BRACKETS	
				and preparing anchorage in molars.	the maxillary or face midline.		Be careful with the inclination of the canines,	
				Arranging arches and improving the overbite.	For expansion with small loads	10 to 12 weeks	these directly influence on the	When both arches are practically
Arranging arches, torque					let it work for longer.		front teeth movement when placed	parallel and the insertion of
and anchorage							in the apparatus.	steel arches is possible.
preparation		.019"x.025" Bioforce	**ACTIVE**	In case of not being able to finish leveling and	If necessary more load can be	4 to 10 weeks*	The bite can be opened in the front section	
		OPTIONAL		aligning.	used 022"x028" Bioforce,		by the positive torque.	
					019"x025" Neosentalloy o 021"x025"			
					Neosentalloy		Evaluate the brackets positioning.	
		.019"X.025" Retranol	**ACTIVE**	Intruding frontals, reducing Spee curve, applying	It is possible to use lower reverse curve			
		INFERIOR OPTIONAL		positive torque to front teeth.	arch.			
STAGE 3								
	3°	019"x 025" steel	**ACTIVE**	Final aligning and leveling for the sliding.	**INDIVIDUALIZING ARCHES**	4 weeks before		
				Closure of extraction spaces.	Round arches to reduce friction or	starting to	Managing the need for anchorage to choose	
Work Stage		018"X018" steel	**INTERACTIVE**	(018"x018"ss) Special for sliding teeth	place adjustable hooks in the arches.	close.	the closure mechanics.***	When dental positions have been corrected
		OPTIONAL		in the arch.	Use 150 or 200 grs. Sentalloy coils		Use low friction of the apparatus.	and extraction spaces have been
				Coordinating arches.	placed on molar			closed.
		021"x025" steel	**ACTIVE**	Issuing the prescription for patients that	6, 7 or with miniscrew.	8 weeks post	Ensure the space closure with metal	
		OPTIONAL		allow using this arch caliber.	Remove bands and attach tubes.	space closure.	ligation up to 4 weeks after closure,	
							to allow radicular recovery.	
STAGE 4								
								Once correctly settled the occlusion,
	4°	.019"x.025" braided	**ACTIVE**	Slowly recovering dental	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination				individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		.021"x.025" braided	**ACTIVE**	Occlusion settlement.	Fiji - 1/8 6 oz.		Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		OPTIONAL					well sharpened pliers, in order not to fray.	time to remove the apparatus

*** Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.**

**** Steel arch 018"x018", is a very good arch for sliding. It is possible to use it after a 019"x025" steel arch.**

***** Refer to space closing methods on page 13.**

CLASS III DENTAL ALVEOLUS WITHOUT OR WITH LIGHT SKELETAL COMPROMISE

STAGE		ARCH TO BE USED	CLIP	GOAL	TIPS	DURATION	WARNINGS	TIME TO ADVANCE
STAGE 1								
					Placing caps in upper back areas			
					to protrude the front teeth.			
		.012" Sentalloy	**PASSIVE**	Leveling, aligning and rotation.			It is possible to let work the upper arch	When the mispositions have been corrected
		OPTIONAL	**Or**	The initial arch section depends	Lower stripping if necessary.	6 to 8 weeks*	for longer than the lower. In the upper part is	the arch will slide from side to side.
Leveled and aligned	1°	.014" Sentalloy	**INTERACTIVE**	on the skeletal biotype, periodontal health			required expansion and protrusion, on the bottom	Advance the sequence as soon as possible
		.016" Sentalloy		and the patient's crowding grade.	Not protruding lower front teeth. The lower		correction without expansion or protrusion.	
		OPTIONAL			arch must not exceed .020" in order			
					not to give lower front positive torque.			
STAGE 2								
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque, finishing correction of malpositions.	For deviating midlines	10 to 12 weeks	RE-ATTACH BADLY PLACED BRACKETS	When both arches are practically
		UPPER		Leaving to work to achieve expansion with small load.	center half of the arch with			parallel and the insertion of
Arranging arches, torque				Coordinating arches.	the maxillary or face midline.			steel arches is possible.
and anchorage	2°	.018"x.020" Sentalloy			Should not apply lower positive torque			
preparation		**LOWER**						
		019"x.025" Bioforce	**ACTIVE**	In case of not being able to finish leveling and	For small crossing bites,	6 to 8 weeks	Be careful with the torque and the buccal	When finishing the leveling and
		UPPER OPTIONAL		aligning.	short elastics can help.		osseous base.	aligning.
STAGE 3								
	3°	019"x 025" steel	**ACTIVE**	In this stage we must finish coordinating	**INDIVIDUALIZING ARCHES**	8 to 12 weeks	Resolving possible upper diastemas	
Work Stage		**UPPER**		dental arches and correcting all	Adjustable hooks can be placed		generated with expansion.	When dental positions have been corrected
				alterations in the 3 senses of space.	on the arch to correct light			only settling the occlusion
	3°	.020" steel	**ACTIVE**	Consolidating lower positions.	clases III and deviating midlines.	8 to 12 weeks		remains.
		LOWER						
		021"x025" steel	**ACTIVE**		Remove bands and attach tubes.	8 to 12 weeks	Be careful with patients of skinny	
		OPTIONAL					periodontal biotype and/or ATM disorders	
STAGE 4								
	4°	019"x025" braided	**ACTIVE**					Once correctly settled the occlusion,
		UPPER		Slowly recovering dental	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination	4°	.0215" coaxial	**ACTIVE**	individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		LOWER		Occlusion settlement.	Fiji - 1/8 6 oz. Italy 5/16" Medium or	8 to 12 weeks	Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		021"x025" braided	**ACTIVE**		Scandinavia 5/16" Heavy for		well sharpened pliers, in order not to fray.	time to remove the apparatus.
		UPPER OPTIONAL			deviating midlines.			

* Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.

CLASS I WITH OPEN BITE DENTAL ALVEOLUS WITH EXTRACTION OF 4 OF THE 2nd MOLARS

STAGE		METHOD TO USE	CLIP	GOAL	TIPS	DURATION	PRECAUTIONS	TIME TO ADVANCE
STAGE 1								
					Place caps on the arch that do not			
					interrupt the correction of		Carry out the extraction of molars	
		.012" Sentalloy			cramming. The cramming must		before attaching the apparatus, in cases of light	
		OPTIONAL	**PASSIVE**	Leveling, aligning and rotation.	be corrected towards the front, if		crowding, or later in cases	When the mispositions have been corrected
Leveled and Aligned	1°	.014" Sentalloy	**Or**	The initial arch section depends	the soft profile allows it and not at the	6 to 8 weeks*	when crowding is severe.	the arch will slide from side to side.
		.016" Sentalloy	**INTERACTIVE**	on the skeletal biotype, periodontal health	expense of the extraction site.		Attach brackets to all teeth	Advance the sequence as soon as possible
		OPTIONAL		and the patient's crowding grade.	Evaluate the right moment for the		1 mm more towards gingival to help close	
					extractions in order to count on		the bite.	
					the extraction space to align		Conserve the extraction space for	
					molars and close the bite.		the mesial move of the molars.	
					Use differential friction.			
STAGE 2								
	2°	.018"x.018" Bioforce	**INTERACTIVE**	Applying torque, finishing correction of malpositions and	For deviating midlines	6 to 10 weeks*	RE-ATTACH BADLY PLACED BRACKETS	
				aiming not to incur rotation in the molars,	center half of the arch with		Do not leave this arch in the mouth long enough	
				to make more their alignment easier.	the maxillary or face midline.		to need leveling, aligning and rotation	
Arranging arches, torque					Some light elastic intermaxillary		Advance with the sequence as soon as	When both arches are practically
and anchorage					can also be used.		possible.	parallel and the insertion
preparation							Distancing of premolars and	of steel arches is possible.
					More load can be used if necessary		apparition of distemas may occur.	
		019"x.025" Bioforce	**ACTIVE**	In case of not being able to finish leveling and	used 022"x028" Bioforce,	4 to 10 weeks	Do not close spaces with this arch.	
		OPTIONAL		aligning.	019"x025" Neosentalloy or 021"x025"			
					Neosentalloy			
STAGE 3								
	3°	019"x 025" steel	**ACTIVE**	Final aligning and leveling for the sliding.	**INDIVIDUALIZNG ARCHES**	4 weeks before		
				Closure of extraction spaces.	Round arches .019"x.025" to reduce	starting to	Managing the need for anchorage to choose	
Work stage		018"X018" steel	**INTERACTIVE**	(018"x018"ss) Special for sliding teeth in the arch.	friction and maintain frontal torque.	close.	the closure mechanics.***	When dental positions have been corrected
		OPTIONAL		using low force.	Place adjustable hooks in the arches.		Use low friction of the apparatus.	and the extraction spaces
				Coordinating arches.	Use 150 or 200 grs. Sentalloy coils			have been closed, correct
		021"x025" steel	**ACTIVE**	Issuing the prescription in patients that	placed on molar 6.	8 weeks post	Ensure the space closure with metal	overbite is achieved.
		OPTIONAL		allow using this arch caliber.	Remove bands and attach tubes.	space closure.	ligation up to 4 weeks after closure,	
					Finish closing with elastic chain.		to allow radicular recovery.	
STAGE 4								
								Once correctly settled the occlusion,
	4°	019"x025" braided	**ACTIVE**	Slowly recovering dental	Using short elastics of	8 to 12 weeks	Use the same size	without interferences or premature
Termination				individuality.	occlusal settling		as the last steel arch used.	contacts during the functioning and with
		021"x025" braided	**ACTIVE**	Occlusion settlement.	Fiji - 1/8 6 oz.		Cut the arch outside the mouth with	correct dento-gingival aesthetics, it is
		OPTIONAL					well sharpened pliers, in order not to fray.	time to remove the apparatus

*** Depends on the response to the patient's dental movement. Allowing the arch to exhaust its working potential in order to advance the sequence.**

**** Steel arch 018"x018" is a very good arch for sliding. It is possible to use it after a 019"x025" steel arch.**

***** Refer to space closing methods on page 13.**

Dentsply Sirona Orthodontics

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