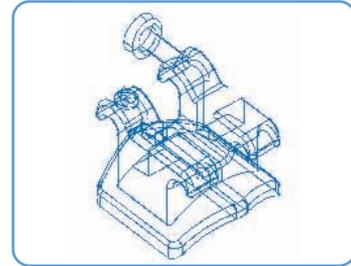


# STEP

system

Ergonomics and efficiency in fixed orthodontics





do you love  
**speed?**

*Slide* <sup>TM\*</sup>  
low friction system



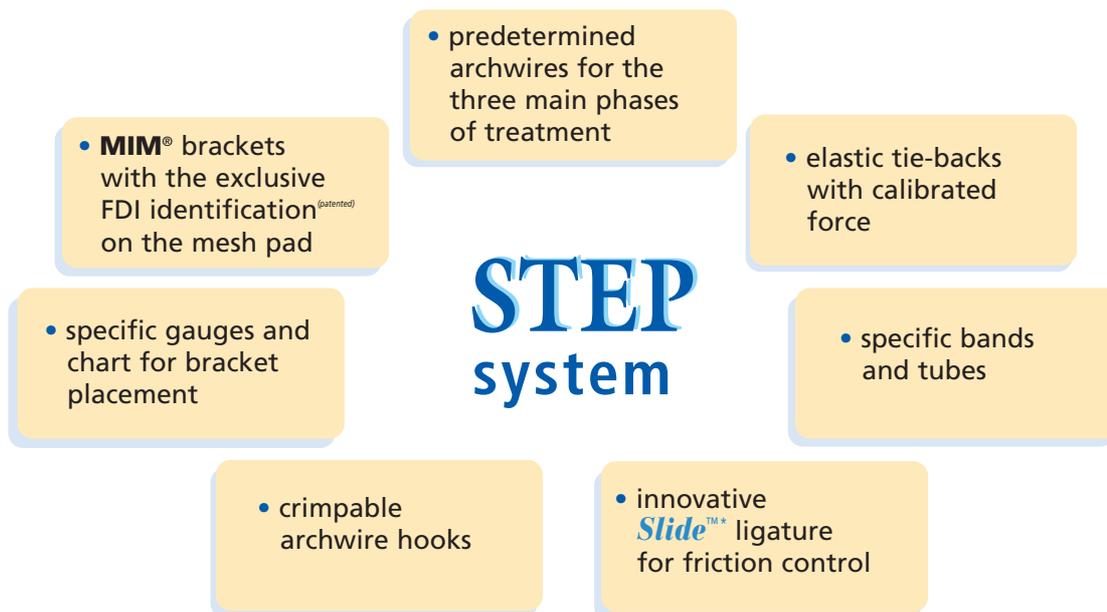
[www.leone.it](http://www.leone.it)

## Ergonomics and efficiency in fixed orthodontics

The **STEP system** is something more than an orthodontic technique. It is a treatment modality that derived both from the expertise of our clinical consultants Dr. Arturo Fortini and Dr. Massimo Lupoli and from the manufacturing technology of our company.

The result is a **systematical approach to different types of malocclusion** aimed to achieve maximum treatment efficiency in the shortest possible time and with patient's satisfaction.

The use of the innovative *Slide*<sup>™\*</sup> ligature allows to exploit fully **the advantages of low-friction biomechanical systems** by decreasing treatment duration and the need for extractions.



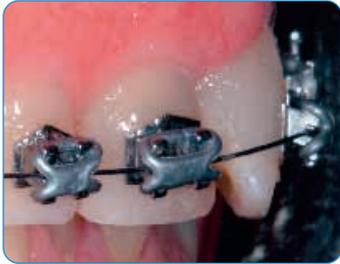
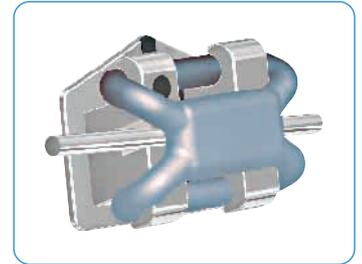
With the **STEP** system the diagnostic evaluation and consequent to treatment planning lead to **predictable and individualized results** for the patient by means of **simplified and standardized** procedures.



## THE LOW-FRICTION *Slide*<sup>™</sup> LIGATURE

The innovative *Slide*<sup>™</sup> ligature used in the **STEP** system is able to control friction adequately during different treatment phases. In other words the clinician can choose the most **advantageous** biomechanics and decide **when, where, and how long** to apply the forces generated by the archwire simply by placing the *Slide*<sup>™</sup> ligature on specific groups of teeth (e.g. upper front teeth).

This versatility allows to exploit the advantages of low-friction system during the appropriate treatment phases **without the use of special brackets** and also to obtain the **maximum three-dimensional control** with the use of conventional ligatures.



*Slide*<sup>™</sup> is a product manufactured with a special polyurethane mix for medical use. It is applied similarly to conventional elastomeric ligatures. Once placed on the bracket, it creates a **passive ligature on the slot** that makes the archwire free to slide and to produce its effects on the dentoalveolar structures.

The particular conformation of the *Slide*<sup>™</sup> ligature improves considerably **patient's comfort** during the first phases of treatment.

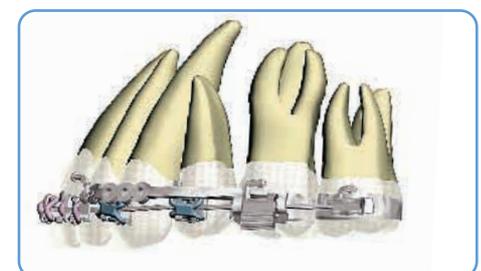
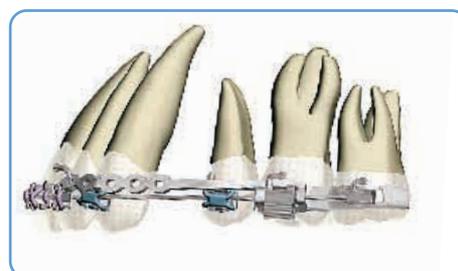


The **STEP** system enables:

- to exploit fully the features of the **Memoria**<sup>®</sup> archwires used with the *Slide*<sup>™</sup> ligatures by applying **light forces** on the dentoalveolar structures with a **"functional" effect**.



- To use **rectangular archwires** that can be ligated on specific groups of teeth to achieve either maximum torque control with conventional ligatures or sliding and space closure with the *Slide*<sup>™</sup> ligature.

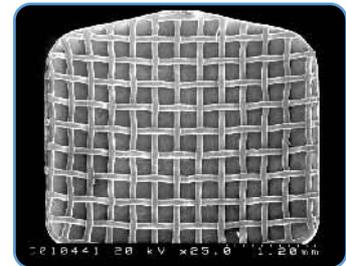
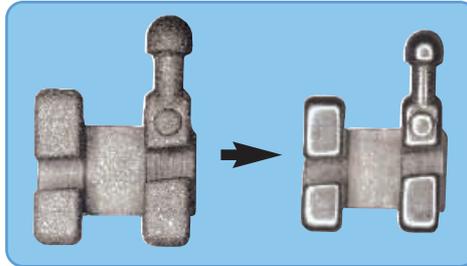
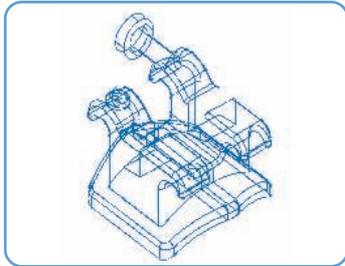


## THE STEP BRACKETS

The **STEP** brackets can be considered as the modern evolution of well-known straight-wire techniques such as the Andrews or the Bennett and McLaughlin techniques. The **STEP** brackets present with small but **fundamental modifications** both in the design and in the prescription. These variations are particularly useful during the positioning phase and the execution of the biomechanical sequence.



The **STEP** brackets have been designed with **CAD/CAM** methodology and manufactured with **MIM**® (Metal Injection Moulding) technology. These advanced technologies allow to obtain high precision, millesimal dimensional tolerance, and perfectly rounded surfaces. The bracket's wings present with **smooth edges and a large area for ligature retention** thus warranting maximum **hygiene and comfort** for the patient. The **ball hooks** of the premolar and canine brackets **are integrated** in the bracket's structure. These hooks facilitate the application of intermaxillary elastics without using Kobayashi ligatures thus favoring **patient's oral hygiene**.



The **biomedical stainless steel** alloy used for the manufacture of the **STEP** brackets is characterized by excellent mechanical properties that guarantee high precision in the expression of tip and torque when the archwire interacts with the bracket's slot. The **80 gauge mesh** bonding pad warrants optimal bond strength. The base of each bracket is carefully shaped both in mesiodistal and occlusogingival directions according to the anatomy of the buccal surface of each tooth. This feature facilitates the correct positioning of the **STEP** bracket on the clinical crown, with minimal amount of adhesive between the base of the bracket and the enamel of the tooth. The risk of debonding and the possibility of inaccurate transmission of the in-out information during treatment are therefore reduced. **The versatility** of the **STEP** system enables the clinician to treat the clinical cases in an individual and personalized manner.

Three possible options are available for the upper canine torque values:

- $-7^\circ$  torque option: to be used in the majority of cases;
- $0^\circ$  torque option: to be preferred in extraction cases in order to maintain the root of the upper canine at the center of the alveolar process without interfering with the cortical bone during sliding mechanics;
- $+7^\circ$  torque option: can be obtained by inverting  $180^\circ$  the canine bracket without hook. This option is useful in presence of bony dehiscence or when the canine roots are prominent.



$-7^\circ$  torque option



$0^\circ$  torque option

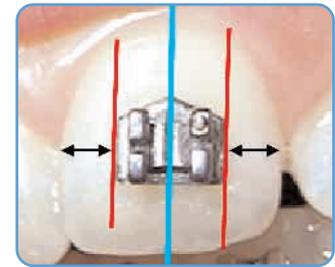


$+7^\circ$  torque option

## BRACKET PLACEMENT

An original idea by Leone, protected by many patents all over the world, has reduced considerably the possibility of bracket placement errors that must be avoided especially with pre-adjusted techniques. Each bracket can be easily identified with the **FDI (Fédération Dentaire Internationale)** system number that is **laser-marked** on the mesh pad. The FDI system **identifies each tooth** with two numbers. The first number indicates the quadrant while the second one identifies the tooth according to Palmer's notation. For example the bracket for the upper right central incisor has number 11 laser-marked on the mesh pad.

Because of its particular morphology, the **STEP bracket can be positioned very easily**. The mesial and distal sides of the base are perfectly parallel to each other and to the bracket's wings.



In the middle of the bracket there is a **laser-marked central line** that together with the arrow-shaped gingival edge simplify the placement of the bracket on the long axis of the tooth. To correctly position the bracket, the central line has to coincide with the long axis of the tooth. The efficiency of pre-adjusted techniques is based primarily on the accuracy in bracket vertical placement.

The essential instruments to control the vertical position are the placement chart that provides the correct distance from the incisal edge and the positioning gauges that are available in four sizes: green (2-2,5 mm), red (3 -3,5 mm), blue (4-4,5 mm) and violet (5-5,5 mm). These instruments are particularly useful to the clinician also because they are extremely handy and easily recognizable by the chromatic code.



The **STEP** brackets are characterized by a **large mesio-distal width** that enhances **three-dimensional biomechanical control** and that allows maximum efficiency during treatment mechanics. Large brackets permit **better control both on rotation and tip** and, therefore, they are particularly efficient in treatment techniques that require sliding mechanics. The introduction of superelastic wires enabled to compensate for the increase in rigidity due to the decreased inter-bracket distance.

The **STEP** brackets are manufactured with **torque in base**. This feature optimizes the application of the forces generated by the archwire as the center of the slot, the center of the base of the bracket and the center of the clinical crown of the tooth are all coincident.

The **in-out** feature of the **STEP** brackets is programmed specifically for each tooth. It respects the original prescription by Andrews and it is in harmony with the arch forms of the system.

## ARCHWIRE SEQUENCE WITH THE STEP SYSTEM



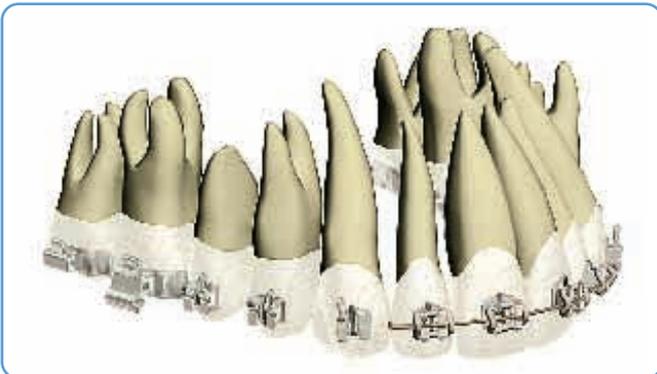
- **Aligning and leveling**

- *Severe misalignment:*  
.014" **Memoria**® archwire
- *Mild misalignment:*  
.016" **Memoria**® archwire
- *Tip control:*  
.016" Australian archwire  
.020" Australian archwire



- **Space closure**

- *Initial torque correction:*  
.019"x.025" Beta-**Memoria**® archwire
- *Space closure with crimped hooks:*  
.019"x.025" stainless steel archwire  
.019"x.025" stainless steel archwire with 20° torque



- **Finishing**

- Upper arch:  
.016" sectional stainless steel wire from 12 to 22
- Lower arch:  
.016" **Memoria**® archwire

## ALIGNING, LEVELING, AND TIP CONTROL

During this phase of treatment the clinician can use **two sizes** of round **Memoria**® archwire. The initial size of the archwire will be chosen depending upon **the degree of misalignment and the periodontal conditions** so that the most appropriate, comfortable and functional force is delivered to the patient.

The **Memoria**® archwires are manufactured in superelastic nickel titanium alloy that undergoes a special thermal treatment to obtain a constant force for a wide range of deformations. The use of this type of archwires with the special **Slide**™ ligature allows to take advantage of the wire properties without the bindings produced by the conventional ligatures. In this way the force delivered by the archwire is more "functional" and the need for extraction can be reduced as well.



The **Memoria**® archwires are manufactured in binary Nickel Titanium alloy with a **crystal structure that is completely austenitic** both at room temperature and in the oral cavity. This feature guarantees the delivery of light and constant forces that are not influenced by changes in temperature like the thermo-active martensitic Nickel Titanium archwires.

After the first phase of treatment, in the archwire sequencing of the **STEP** system the use of round .016" and .020" round **heat-treated** stainless steel archwires with high mechanical properties (Australian wires) is recommended. These archwires allow the clinician to stabilize the results of the aligning phase and to control the root tipping effectively.

### SPACE CLOSURE AND TORQUE CONTROL

The subsequent application of a .019"x.025" Beta-**Memoria**® archwire in titanium molybdenum alloy with special properties is indicated to start the phase of torque control gradually and progressively with maximum patient's comfort.



The aims of this phase of treatment are the **control and correction of both overbite and overjet** during space closure. In order to achieve these objectives **.019"x.025" tempered stainless steel** archwires are recommended both plain and with 20° torque. These archwires due to their rectangular section allow to control the torque. In combination with the elastic tie-backs attached on the hooks crimped between the lateral incisor and the canine these archwires can be used to produce an "en-masse" retraction of the anterior teeth. **The preformed elastic Tie-Backs** consist of a special elastic module - that can be attached on the molar tubes - and of an anterior perforated extension similar to a chain - that allows to modulate the force applied to the hooks crimped on the archwire. The retraction of the anterior teeth can lead in some instances to the loss of torque in the incisor roots that can be compensated by using a 20° pre-torqued archwire. In these cases the clinician has to eliminate the torque in the posterior regions of the archwire with two ribbon arch pliers placed close to the crimped hooks, in order to facilitate archwire sliding in the posterior brackets. The use of the **Slide**™ ligatures with this type of rectangular wires in specific portions of the arches permits the application of biological forces and, consequently, it reduces treatment duration.



### FINISHING

The finishing phase is carried out with preadjusted brackets similarly to the most recent techniques. A .016" **Memoria**® archwire is placed in the lower arch (in some cases the archwire used previously during the leveling phase can be re-applied) while in the upper arch a .016" round stainless steel sectional wire is positioned from the right to the left lateral incisors. This particular technique enables some degree of extrusion of the upper posterior teeth in order to improve the occlusal interdigitation.

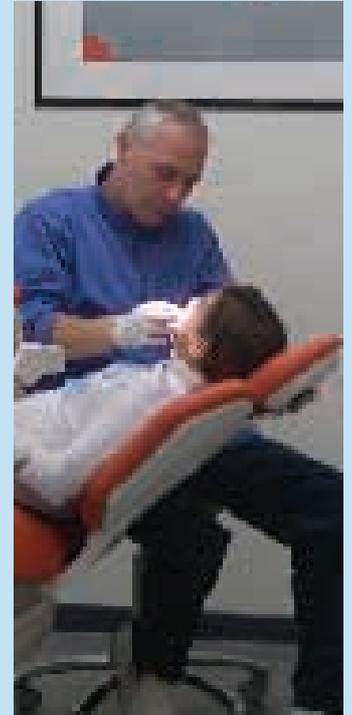


## CASE REPORTS



### Dr. Arturo Fortini

*Dr. Fortini graduated in Medicine and Surgery at the University of Florence in 1977. He specialized in Dentistry at the University of Florence. He is Active Member of S.I.D.O. and International Member of the A.A.O. Dr. Fortini is also Fellow of the W.F.O. and Member of the E.O.S. and of the A.A.F.O. He received the Certificate of Excellence in Orthodontics (Italian Board of Orthodontics) in year 2001. He published several articles both in Italian and international journals. He practices orthodontics exclusively. Dr. Fortini is a clinician with a special expertise in the Straight-Wire technique by Bennett and McLaughlin.*



***Dr. Fortini and Dr. Lupoli are scientific consultants and official speakers for the Leone Step System. They have given lectures and courses in Italy, United States, Mexico, Spain, Portugal, Czech Republic, and Russia.***



### Dr. Massimo Lupoli

*Dr. Lupoli graduated in Medicine and Surgery at the University of Florence in 1982 and specialized in Dentistry at the University of Florence. He is Active Member of S.I.D.O. and International Member of the A.A.O. Dr. Lupoli is also Fellow of the W.F.O. and Member of the E.O.S. and of the A.A.F.O. He has been invited as speaker at the Continuing Education Course in Functional Orthodontics at the Institute of Dentistry at the University of Helsinki. He obtained the Post-Graduate Certificate at the College of Dentistry of the New York University and the Certificate in Pre-Surgery Orthodontics at the Mount Sinai Hospital in Detroit. He also received the Certificate of Excellence in Orthodontics (Italian Board of Orthodontics) in year 2003. Dr. Lupoli has presented four seminars in orthodontics at the School of Dentistry of the University of Bari during the academic year 1993/94. Dr. Lupoli has been appointed as teacher by the Tuscan Region for the continuing education course in orthodontics for pediatricians in years 1996 and 1997.*





#### L.C., MALE SUBJECT, 23.6 YEARS

This patient presents with a long face with slight asymmetry. The lips are competent, hypertonic and protrusive with respect to the esthetic lines. The nasolabial angle is greatly reduced. He shows skeletal Class I with severe hyperdivergency and Class I molar relationship with severe dental openbite. The upper and lower incisors are protrusive and proclined. Both arches show moderate crowding. This patient had received previous orthodontic treatment that consisted of removable appliances at the age of 8-9 years followed by fixed appliances from the age of 13 years through the age of 18 years. The patient's chief complaints were the anterior openbite and the gingival recessions even though he was aware of the fact that a complete resolution of the malocclusion could be achieved only through orthodontics and orthognathic surgery.

#### TREATMENT PLANNING:

1. extraction of the four first premolars to correct crowding with the aim of avoiding detrimental dento-alveolar expansions.
2. Maximum posterior anchorage in relation to the incisor position.
3. Individualized bracket placement in order to control the occlusion, the recessions and to facilitate sliding mechanics.



#### 3 MONTHS

Brackets have been placed initially also on the first premolars to assist in the creation of ideal shape of both arches. The individualized bracket placement can be noted:

1. the incisor brackets have been placed 0.5 mm more gingivally than the values reported in the placement chart to induce a controlled extrusion for openbite reduction.
  2. The canine brackets are placed upside down to obtain a change in torque values from  $-7^\circ$  to  $+7^\circ$  that would improve both the vestibular position of the canine roots and the gingival recessions.
- .016" Thermomemoria® archwires with Lace Backs and Bend Backs were used.

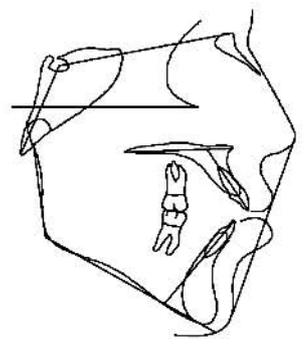
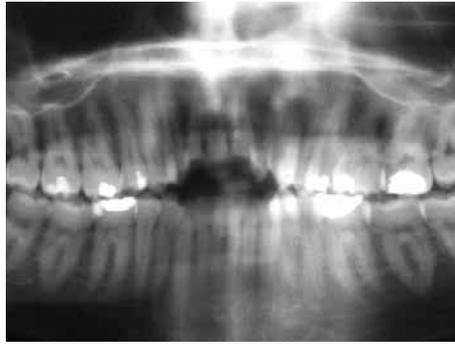
#### 7 MONTHS

During the premolar extraction phase the Lace Backs are transformed from passive into active. Consequently, some degree of improvement in the crowding in both upper and lower arch can be observed.

Leveling created by the archwires together with individualized bracket placement are producing the planned improvement in the occlusion.

#### 9 MONTHS

A quick tendency to collapse in the transverse dentoalveolar dimensions can be observed frequently after extractions especially at the lower arch. Consequently, in the lower arch the active Lace Backs were replaced by Class I elastic tractions between the canines and the posterior teeth to occupy rapidly the extraction site.



## 12 MONTHS

Upper arch: the .016" Thermomemoria® archwire completed the leveling and aligning phase. After 3 months of treatment with a .019"x.025" Thermomemoria® archwire a .016"x.022" stainless steel archwire was placed in the lower arch so that a Memoria® open coil spring could be used to create space in the incisor region. A gradual improvement both in crowding and in anterior openbite can be observed.

## 15 MONTHS

In the lower arch the crowding has been corrected and the open coil spring has been removed. Alignment has been completed with a .016" Thermomemoria® archwire.

## 18 MONTHS

In both arches .019"x.025" stainless steel posted archwires with passive Tie Backs have been placed.

## 20 MONTHS

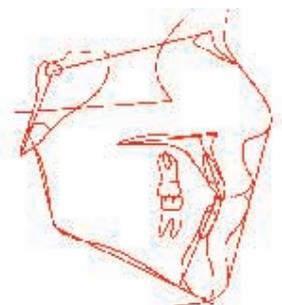
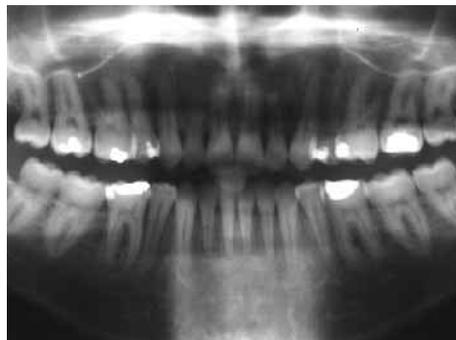
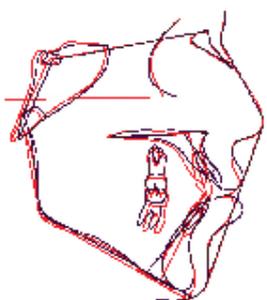
A phase of space closure: .019"x.025" stainless steel posted archwires with elastic Tie Backs.

## 24 MONTHS

Removal of fixed appliances. Very good occlusion and good shape of both arches can be observed. A complete closure of anterior openbite was obtained together with a good alignment and complete closure of extraction sites. From a periodontal point of view an improvement in gingival recessions was achieved through a good control of root positions. This favorable result was obtained thanks to the versatility of the system and to the individualized bracket placement.



The patient shows an improved harmony of the face. The nasolabial angle has been increased while the lips have been retruded significantly to achieve a normal position with respect to the esthetic lines. The lips do not show signs of muscular hypertone. The long-face appearance is still evident as it could not be changed by orthodontic treatment alone.





#### N.F., FEMALE SUBJECT, 11.7 YEARS

This patient shows an oval face shape with good symmetry. The lips are competent and slightly protrusive with respect to the esthetic lines. The nasolabial angle is reduced. A slight muscular hypertone is visible at the lower lip. The patient presents with skeletal Class I and normal vertical relationship. She also shows Class II molar relationships and crowding at the upper arch with lack of space for the eruption of the permanent canines.

### TREATMENT PLANNING:

First phase of molar distalization with the Leone First Class appliance followed by fixed appliance therapy with the **STEP** System straight wire technique. No crowding is present at the lower arch. The Leeway space will be maintained to correct the position of the lower incisors if necessary during the final phase of treatment.

#### 3 MONTHS

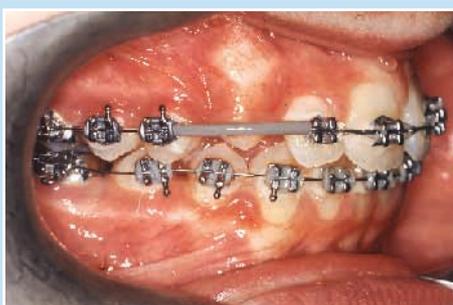
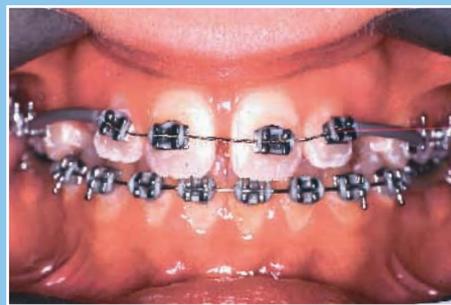
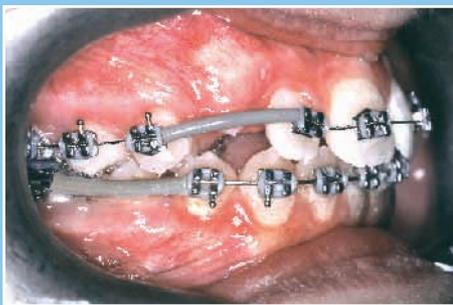
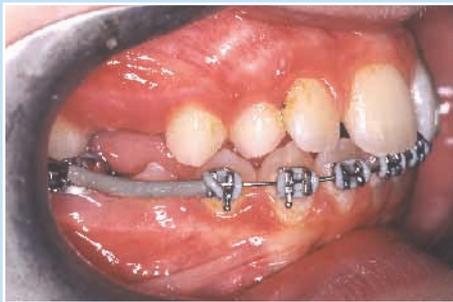
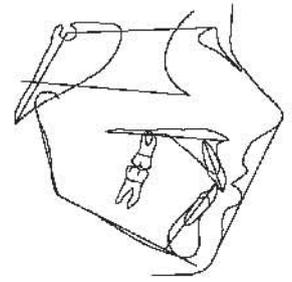
In the upper arch the Leone First Class appliance produced 4 mm distalization of the first molars. After the active phase of treatment with the Leone First Class, the appliance was transformed into a space maintainer (Nance holding arch) in order to preserve the gain in arch perimeter while waiting for the eruption of 25-45 and 13-23. Brackets at the lower arch had been placed already during the distalization of the upper molars. The archwire sequence in the lower arch was .014" Memoria® archwire, .016" Memoria® archwire, .018" stainless steel archwire with an elastomeric protective tube to maintain the space for the second premolars.

#### 6 MONTHS

Once the upper second premolars had erupted the upper arch was bonded. A very light .0155" flex archwire (twisted stainless steel wire) was chosen as first archwire for alignment because the patient was very sensitive to pain. Leveling and aligning at the lower arch was completed with a .020" stainless steel archwire before the eruption of second premolars.

#### 9 MONTHS

At the upper arch a .018" stainless steel archwire was placed with an elastic chain at the incisors to close the central diastema that was present from the start of treatment and to facilitate the spontaneous eruption of the permanent canines. The elastomeric protective tube was used both to protect the labial mucosa and to maintain the space for the eruption of the permanent canines. In the lower arch the erupted second premolars were bonded. A .014" archwire was used to align and derotate the second premolars.



## 13 MONTHS

Upper arch: a .020" stainless steel archwire was applied to stabilize the closure of the central diastema while waiting for the complete eruption of the permanent canines.  
Lower arch: alignment was completed by using in sequence .014" Memoria® and .016" Memoria® archwires, .018" and .020" stainless steel archwires.

## 15 MONTHS

The permanent canines have erupted in good position. Brackets were placed on these teeth and alignment was optimized with a .018" Memoria® archwire.  
In the lower arch a .019"x.025" stainless steel posted archwire with passive Tie Backs was applied to stabilize the arch and to let the brackets express fully the torque information.

## 18 MONTHS

In both arches .019"x.025" stainless steel posted archwires with passive Tie Backs are present. In the upper arch an elastic chain was added on the central incisors to control the relapse of the diastema.  
Class II elastics were also applied to control the overjet, the overbite, and the slight midline deviation.

## 20 MONTHS

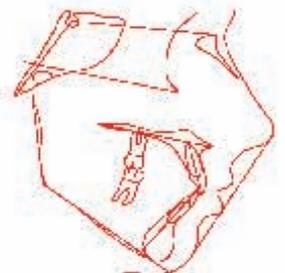
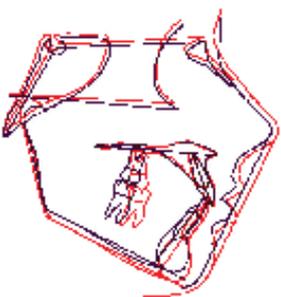
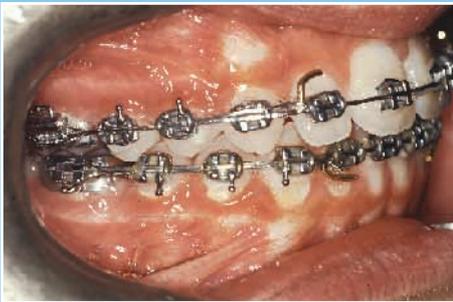
Finishing: .014" Memoria® archwire in the lower arch and sectional .020" stainless steel wire at the upper incisors. Vertical elastics were used (fulltime wear for the first two weeks and night-time wear for the following two weeks) to achieve maximum intercuspation and a natural settlement of the occlusion.

## 21 MONTHS

Debonding: a very good occlusion is present, overjet and overbite are normal, good shape of both arches can be observed.



The patient shows a very good facial harmony. The nasolabial angle is increased, and both lips are in normal position in relation to the esthetic lines. No sign of muscular hypertone of the lips is visible. The patient's face is oval in shape with good symmetry.





**A.J., FEMALE SUBJECT, 12.6 YEARS**

This patient shows skeletal Class I with increased vertical relationships. Class III molar and canine relationships can be observed on the right side while Class I molar and Class III canine relationships are present on the left side. Severe proclination of both upper and lower incisors is associated with severe crowding in both arches with lingual displacement of the upper second premolars. The midlines are coincident, the overbite is reduced while the overjet is normal.

The face is symmetrical and the profile is moderately convex. Extractions in both arches were planned with particular attention to the final torque of the incisors to avoid excessive flattening of the profile.

**TREATMENT PLANNING:**

1. extraction of the upper second premolars and of the lower first premolars.
2. Maximum anchorage at the upper arch with a nickel titanium expander and at the lower arch with a lingual arch.
3. Fixed appliance at the upper arch with Lace Backs and Bend Backs. Fixed appliance at the lower arch consisting initially of brackets placed only on the lower canines with active Lace Backs to correct crowding. Brackets were not placed on the lower incisors to avoid excessive proclination.
4. Leveling and aligning in both arches.
5. Overjet and overbite control with space closure.
6. Finishing and detailing.



**START OF TREATMENT:**

the upper second premolars were extracted. A Nickel Titanium expander was applied at the upper arch to achieve a complete derotation of the first molars. This appliance was used as anchorage device during the following phases of treatment. At the lower arch a lingual arch was to obtain maximum anchorage during the correction of the incisor crowding after the extraction of the first premolars.



**1 MONTH**

Brackets were applied at the upper arch. Leveling and aligning was started with a .0155" stainless steel twist archwire with Lace Backs and Bend Backs.

Lower arch: brackets were placed on the permanent canines before extracting the first premolars. Brackets were not placed on the lower incisors because the canines were in a buccal position that would determine an excessive proclination of the front teeth.

**4 MONTHS**

Upper arch: leveling and aligning phase of treatment was completed with a .018" stainless steel archwire. An elastic chain was placed on the upper incisors to close the space created between the central incisors.

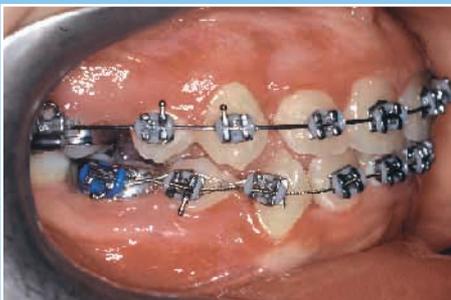
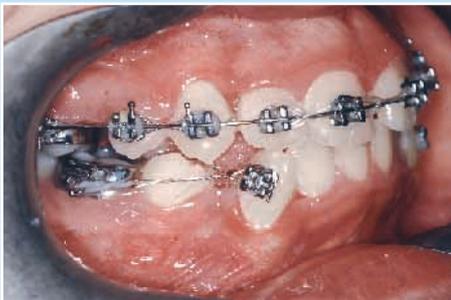
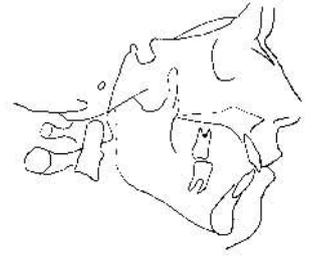
Lower arch: active Lace Backs were used to continue the retraction of the canines to correct the anterior crowding.

**6 MONTHS**

Upper arch: a .020" stainless steel archwire was applied to complete leveling and aligning. Lace Backs were removed as the anterior crowding was corrected while Bend Backs were maintained.

Lower arch: brackets were applied and leveling and aligning was started with a .0155" stainless steel twist archwire with Lace Backs and Bend Backs.





## 7 MONTHS

Upper arch: a .019"x.025" stainless steel posted archwire with passive Tie Backs was placed to start space closure and to control overbite and overjet.

Lower arch: a .016" Memoria® archwire was applied to complete leveling and aligning. The Lace Backs were removed while the Bend Backs were maintained.

## 12 MONTHS

Upper arch: the .019"x.025" stainless steel posted archwire with passive Tie Backs was kept in place while waiting for the closure of the space between 43 and 42 and for the following coordination of the arches.

Lower arch: a .019"x.025" stainless steel posted archwire was used with active Tie Back on the right to close the space between 43 and 42 and passive Tie Backs on the left where the spaces had been already closed.

## 18 MONTHS

.019"x.025" stainless steel posted archwires with passive Tie Backs are still in place. The extraction spaces have been closed and there is good control of both overjet and overbite. A slight Class II molar relationship still persists on the right. It will be corrected with the use of intermaxillary Class II elastics.

## 20 MONTHS

Finishing: .014" Memoria® archwire in the lower arch and sectional .020" stainless steel wire at the upper incisors. "W" or "M" intermaxillary elastics were used to detail the occlusion.

## 22 MONTHS

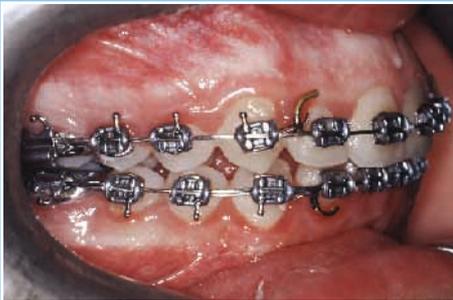
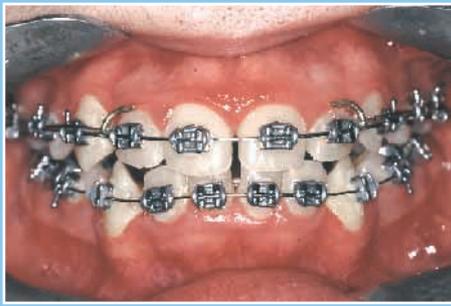
End of treatment: optimal bilateral Class I molar and canine relationships.

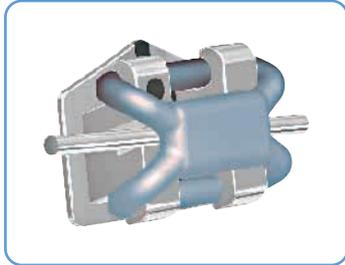
The correct position of the distobuccal cusp of the upper first molar in relation to the lower second molar can be observed (first key of occlusion according to Andrews).

Overjet and overbite are normal and the midlines are coincident.



The patient's face is symmetrical with substantial improvement in the profile. The extractions did not affect the position of the lips that show a normal relation to the esthetic lines. The nasolabial angle is reduced. The smile is full and no black corners are evident due to the corrected shape of both arches.





**Orthodontics and Implantology**

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