SLOW MAXILLARY EXPANSION

USING A NEW SPRING – LOADED DEVICE

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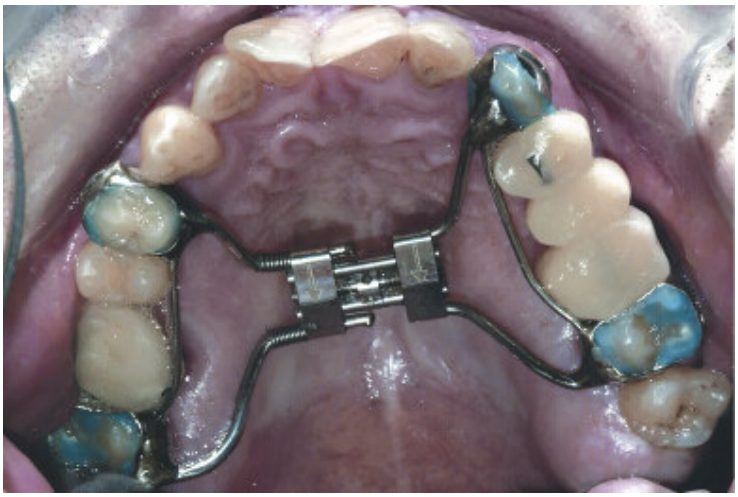
During the period of research and experimentation that lead to the launch of the 'FastBack' Molar Distalizer, we extended our research towards devices that would allow us to maintain an accurate control over the direction and intensity of the forces applied when seeking Maxillary Dentoalveolar Expansion in patients whose growth has almost finished.
From this research project, the new Spring-Loaded Expander (SLE) was born. **The SLE is a new Orthodontic device designed to provide expansion of the upper arch by means of pre – determined, continuous forces.**

The Leone A2702-08 Spring-activated Expander – Demonstration Model

Before choosing the right device for each patient, the Orthodontist should make an accurate assessment and case analysis based on both the available clinical data as well as the study of the gypso models and our cephalometric evaluations.
What we need to ascertain with our observation is whether the patient presents a Maxillary Deficiency that fits in the following classification by C. Lanteri and R. Olivi:

1) BASAL or SKELETAL characterized by insufficient development of the Middle Third of the face.
2) MAXILLO-ALVEOLAR (or Maxillary *Endoalveolie)*, with a Bone Base that is normally developed but with a poorly expanded alveolar structure.
3) DENTAL-MAXILLARY that can be associated with lingual inclination of one or more teeth in the upper arch.
4) MANDIBULAR DENTAL, caused by vestibular inclination of one or more teeth in the lower arch.
5) MANDIBULAR DENTAL (*Esoalveolie),* showing a transversal excess of the lower alveolar processes.
6) BASAL (MANDIBULAR SKELETAL) determined by an excessive mandibular growth.
7) SKELETAL - RELATIVE determined by a backward position of the upper arch in relation to the lower – or the other way around, as can be found in Class III cases.
8) MIXED as the above conditions are often found combined.

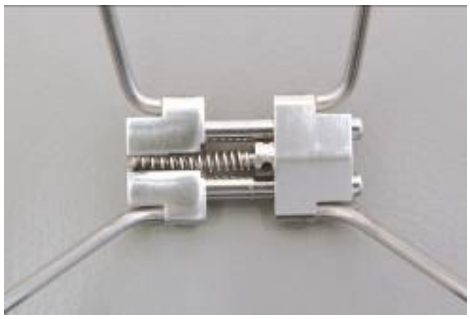
The SLE is especially useful in case of Alveolar Deficit. The device in its prototype stage was clinically tested for 36 months prior to the design and manufacturing of the definitive screw, which was subsequently released by Leone in 2003. Before then, all prototypes were made using modified components from existing Rapid Palatal Expanders (Fig. 3 and 4). Nickel-Titanium spring coils were added to the arms of the expander to absorb the intensity of the force generated by its screw.



Basically, a device that had originally been conceived to carry out an orthopaedic action involving forces of 10 Kg or more was modified in such a way that it would generate light (grams) orthodontic forces.

The new SLE is equipped with either a 500 gr. (A2701-08) or an 800 gr. (A2702-08) spring coil allowing the release of a continuous force that is enough to promote a Dental-Alveolar re-modelling that is biologically ideal and biomechanically controlled. The screw features a self-stop mechanism at the end of expansion to prevent it from disassembling in case of excessive activation (Fig. 5a – 5d). The following photos show the new SLE with a section of the body removed to expose its mechanism.

5a – SLE is fully compressed at the start of treatment.



5b – SLE showing spring coil completely open (passive) -approximately 3mm of expansion have been achieved.

5c – The SLE has been re-activated and the spring coil is compressed again. This way, the screw will resume its dental expansion action.

5d – 8mm is the maximum expansion obtainable with the SLE.

The device is activated at the Orthodontic Practice (Surgery); on average, 4-8 activations (0, 4-0, 8 mm) every 6 weeks are required. A different number of activations will not alter the intensity of the force delivered to the dental structures, as this stays constant (500 or 800 gr.) thanks to the action of the spring coil; what will change is the amount of millimetres of space gained between each appointment with the patient. There is no risk of over-expansion as the screw, upon reaching the pre-determined expansion, will become passive.

<u>From a biomechanical point of view, the new SLE is completely different from other fixed appliances such as the Gosgharian bar, the Quad-Helix or the 'Veltri' Screw. These are some of the points in its favour:</u>

- Easy, infrequent activation, done at the dentist's surgery.
- Tipping is also easy to control, through bodily vestibular movement. With regard to this, it is essential that the appliance be accurately positioned level with the undercuts of the highest possible number of teeth and that the appliance has wire extensions reaching as far as the permanent canines when these are present.
- An accurate monitoring of movement is possible.
- Occlusal forces cannot influence or alter the activation, so safety is certain.
- Only continuous, predetermined forces are at work in between appointments.
- The SLE permits to determine with precision the amount of movement to be achieved.
- Should the patient miss an appointment, no harm can arise, as there can be no over-expansion.

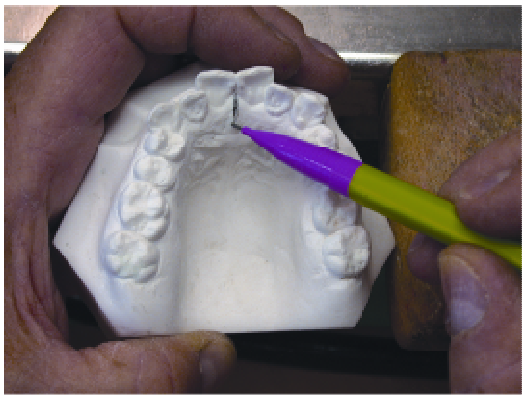
CONSTRUCTION OF A SPRING LOADED EXPANDER

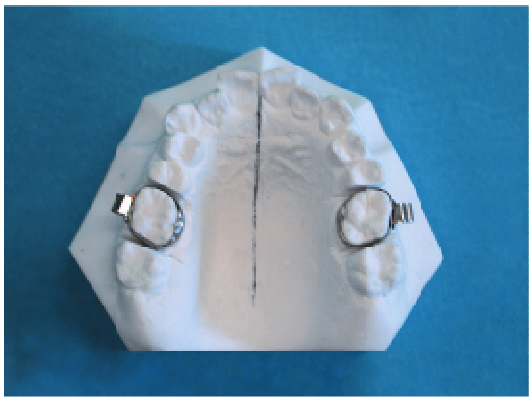
It is recommended that the Dental Orthodontic Technician construct the appliance using the prescription sheet and habitual impression waxes (upper and lower) for technical reference. The impressions can be taken either after the bands have been tried on or, alternatively, the choice of bands can be left to the Technician. It is also recommended that the Orthodontist indicate which dental elements will have to provide anchorage – that is where bands or occlusal rests have to be placed.

Once the models have been poured, choose and place bands, then adapt the expander for slow expansion. Doing this, some general rules always have to be followed:

Leave some leeway spaces between the body of the expander and soft tissues	The appliance generates dental movement; in case of errors, the body or the arms of the expander can cause compression and sores to the mucosa
The SLE must be modelled in such a way that the forces applied are on an axis with the occlusal plain	In order to avoid unwanted intrusion or extrusion movements
The opening gap of the SLE must be perpendicular to the maxillary midline.	In order to avoid unwanted rotation, mesial or distal movements of teeth
Place the SLE as high in the palate as possible	To minimize discomfort to the tongue during swallowing and/or phonation. Also for better biomechanics
Unless specifically prescribed, the same force must be applied to left and right sections of the maxillary arch.	It is possible to obtain asymmetric forces only by varying the anchorage; A certain dental area can be given a higher or lower pressure.
Always provide the appliance with anterior extensions to the permanent canines when possible	This makes for better anterior expansion of the arch

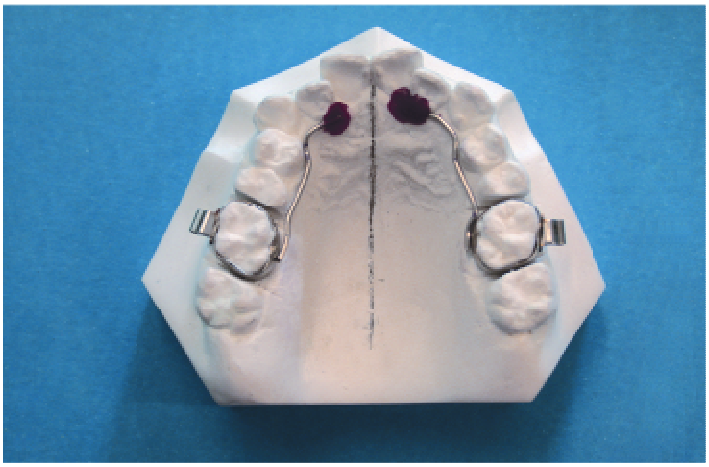
Once the model is poured, trace the suture line with a pencil (Fig. 6 and 7) to visualize the maxillary midline for a correct positioning of the screw


F. 6

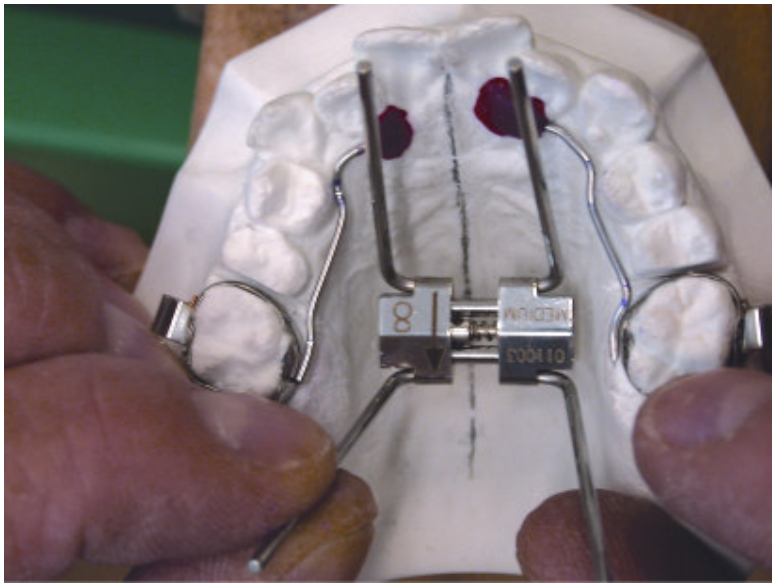

F. 7

Using 0.9mm Chrome-Cobalt wire, build the rear premolar extensions, which have to rest against all the dental elements we want the device to influence with its action (Fig. 8 and 9).


F. 8


F. 9

Once the extensions are completed, start modelling the arms of the SLE. To do this, use a pair of Angle laboratory pliers and a Leone P1050-00 arm – bending instrument (fig.10).


F. 10

Pay the greatest attention to leaving adequate leeway spaces between the body of the screw and the patient's soft tissues (during this stage the screw is open and the spring coil is passive).

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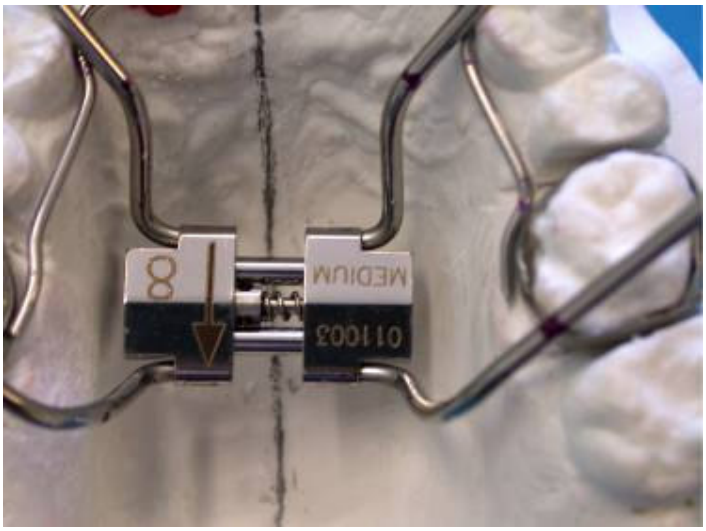
Test-position the screw, with its spring coil open, against the model, to be able to visualize a large enough leeway space. In those cases where considerable expansion is needed, leave enough space on both sides to avoid sores to the palatal mucosa during expansion.

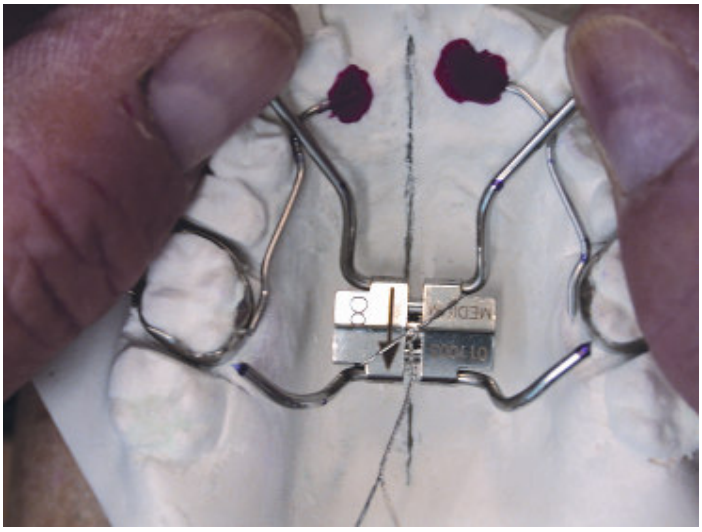
Remember to position the screw along an axis with the palatal suture and parallel to the occlusal plain; this in order not to apply unwanted forces on asymmetric plains as this could cause intrusion, extrusion or even rotation movements.

The anterior arms of the SLE must support the action of the rear premolar extensions in the canine/first bicuspid area, while the rear arms will engage the rear premolar structures of the appliance in the molar area (Fig.11)

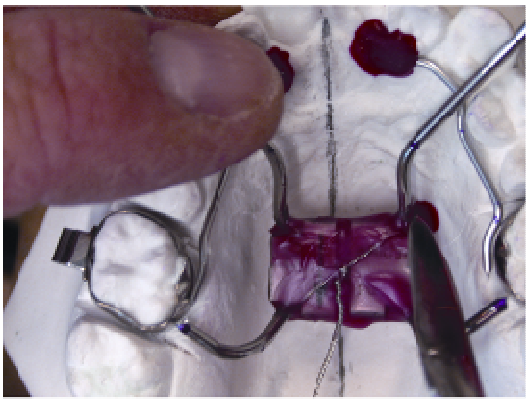


F.11

Once this stage in the construction has been reached, cut off all excess length of the arms using a pair of heavy cutters, then block the screw with a piece of metal ligature (Fig. 12), compressing the two halves of the screw until they come in contact.


F. 12

Wax down the body of the screw and block all parts (away from the areas to be soldered, welded or laser-welded) with sticky wax (Fig. 13), then protect same parts with thermo insulator.

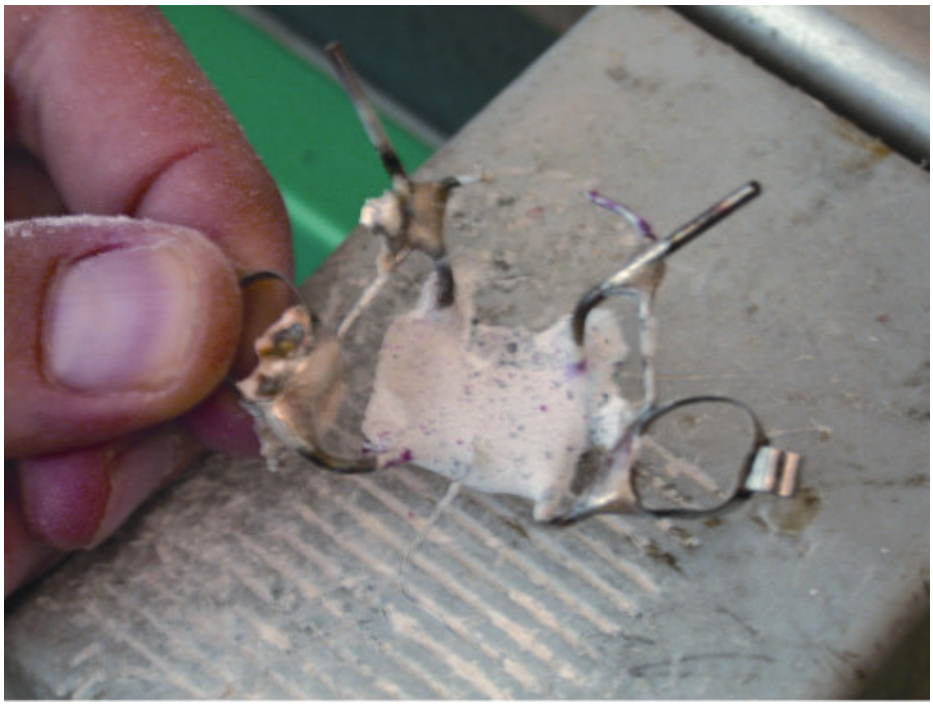


F. 13

Join the various components using the soldering method of choice. Finish and polish (Fig. 14, 15 and 16).

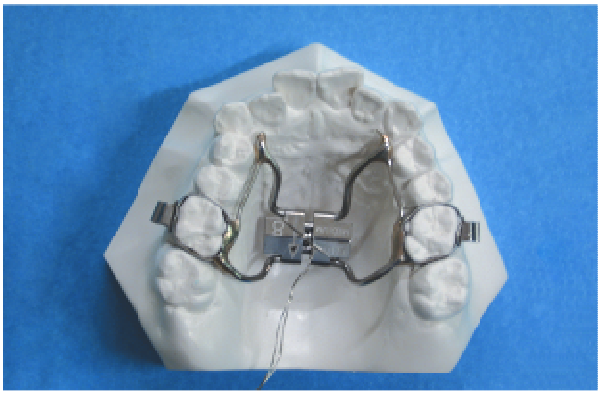
F.14

F.15



F. 16

Once the device has been assembled and cleaned, tie up the body with a piece of metal ligature to allow the dentist to place it with ease (Fig. 17 and 18).



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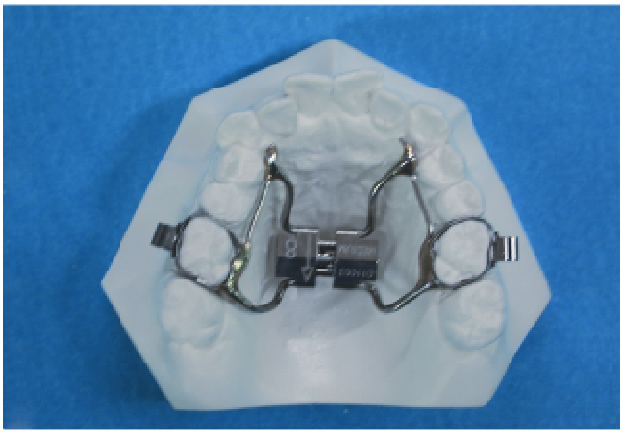
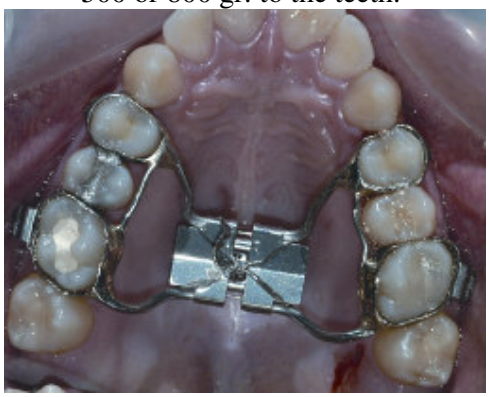


F. 18

IMPORTANT:

Attempting to apply a SLE without any ligature around it may result in a vestibular shifting movement of the bands in respect to the teeth, on account of the natural action of the spring coil. After cementing, the Orthodontist must cut the ligature, thus allowing the SLE to begin its action, transmitting a force of either 500 or 800 gr. to the teeth.



As well as the slow dentoalveolar expansion for which it was conceived, the SLE can be successfully used towards Orthopaedic (rapid) expansion of the palatal midline, simply by changing the activations patterns.

To achieve separation of the palatal midline, bring the SLE immediately to its maximum compression by giving it a complete activation. From this point onwards, any further activation will transfer a force with an intensity of a few Kilograms, as generated by the screw, directly to the anchorage elements. Clinical tests are currently underway to document this particular procedure and the correct operative protocols for activation and management of the screw.

Figures 19 and 20 show the SLE in a clinical application, prior to the beginning of activation, with metal ligature still in place (20) and approximately 6 months later after de-banding, (21).

F. 19 

 F.20