

## Research Article

# Design of a Unique Distraction Device for Alveolar Bone and Oral Rehabilitation

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### Article History

Received: 24.09.2019

Accepted: 03.10.2019

Published: 30.12.2019

**Abstract:** This work is about a new design of an Alveolar Distractor with the purpose of offer to a patient more treatments alternatives. We have received many patients at the hospital level and we have seen the need to build devices to achieve perfection in our treatments. This devices built can be based on those that are manufactured in series. We want to insist that teamwork is essential and that the Oral and Maxillofacial Surgeon cannot be far from the Rehabilitation Professional. Both should study the problems of each person. The feasibility and effect of each manufactured device should be evaluated and It will be necessary to study in depth each case in particular and form a multidisciplinary team of professionals who can provide solutions. A teamwork is essential to achieve excellence. It will become a new modality of attention. In this work we present the following three of eight devices built.

**Keywords:** Oral, Mouth, Maxillofacial, Surgery, Surgeon, Teamwork, Appliances, Devices, Apparatus, Design, unique, Bone, Multidisciplinary, Distraction, Alveolus, Alveolar Distraction.

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## INTRODUCTION

We cannot speak of the term "Bone Distraction" without thinking of a device to be installed in the patient that induces this work (Ilizarov, G.).

We must recognize that there are countless distracting devices on the world market that, once correctly positioned, perform the desired work for which they have been conceived (Ilizarov, G.).

As an alternative treatment, the distracting technique was considered, but not before studying the case in depth and achieving the best operative technique with an apparatus that performs optimal work.

We always refer to a state of "Natural Bone Regeneration" and that is why we always aim at the

design of an apparatus that, using our inventiveness, induces us to a directed Alveolar Distraction and that executes us a feasible work conceived for this purpose (Ilizarov, G.).

We mention Dr. Gavril Ilizarov, who is the father of this operation technique and who said that the problem must be solved for each patient at all costs, without sparing treatment costs (Ilizarov, G.).

We have inverted a lot of time in designs and after many trials and errors, we have achieved excellence in producing devices that reach our goals.

Osteogenic distraction is a widely used technique in which any bone in the body can be enlarged by a distracting device placed in a surgical procedure (Ilizarov, G., & Stryker Leibinger Co.).

It consists of making a physical cut of the bone to achieve the separation of the cutting ends by means of the distracting device that acts producing a gradual and measured distance (Andrade-Guerra, A., & Lander Hoffmann, A. 1999; Andrade- Guerra, A., & Campos Rodriguez, M. 2018).

A very important detail is that once the bone separation is carried out by placing the distractor device, the bone ends remain permanently immobile for a period of time so bad that the distraction procedure is not fully successful. That is why the distractor must be very careful and protected by the patient (Casillas. Máquinas; Andrade-Guerra, A. 1998; Andrade- Guerra, A., & Campos Rodriguez, M. 2018). In this way, a natural bone regeneration or osteogenesis will be induced by using the body's natural mechanisms. No type of transplant, injector or bone material is placed between the ends that separate. There can be no rejection (Andrade-Guerra, A.; Andrade- Guerra, A., & Campos Rodriguez, M. 2018; Bell, H., & Samchucov, G. 1997).

In dentistry, both the mandibular and maxillary bones are sometimes in a natural process of resorption when the exodontics of any dental organ is practiced.

There are very common cases of extensive resorption and irregularities of the alveolar ridge, presenting a slope that makes rehabilitation impossible (Garg, A.).

In this case it is not possible to place a dental implant because there is no ideal bone volume. It is at this time when we go to the bone distraction technique and place the distractor to position an implant that will have the appropriate superstructure or "Pillar" to start our oral rehabilitation (Andrade- Guerra, A., & Campos Rodriguez, M. 2018).

It should be noted that for a rehabilitation to occur, a previous distraction must be continued by placing the distracting device (Operation No 1) and then when a bone enlargement is achieved, our

Distractor Device must be removed giving way to a second intervention.

Then, the patient will undergo a third surgery to place the appropriate dental implants and achieve a proper rehabilitation phase.

It is at this step that it is recognized that very skilled Surgeons will place the implant in a second time at the time of removing the Distractor Device, in order to save a very appreciable surgical step by the patient and the operator.

Always, despite the skill of the Operating Surgeon, a third intervention is preferred.

Seeing one of the Distractor Devices used in the market, we wanted to manufacture a different one.

## **MATERIAL AND METHODS**

For the manufacture of this device, a North American Peerless brand lathe was used and we use titanium material of formula Ti90Al6V4 with certificate that prove this combination of metals according to the supplier house and given that it is an apparatus that will be inside the organism, we were careful to strictly follow the specifications and requirements of the ASTM.

The finish will have to be machined to achieve the excellence of an optimal device that meets our requirements that are those of the patient. We have taken into account the machining temperature and working differences according to the different types of metals (Casillas. Máquinas).

We eliminate the concept of "Adaptation" and we are sure that we can position a design in a more busimple way. It is worth talking about the security that must always reign in us when we feel that comfort.

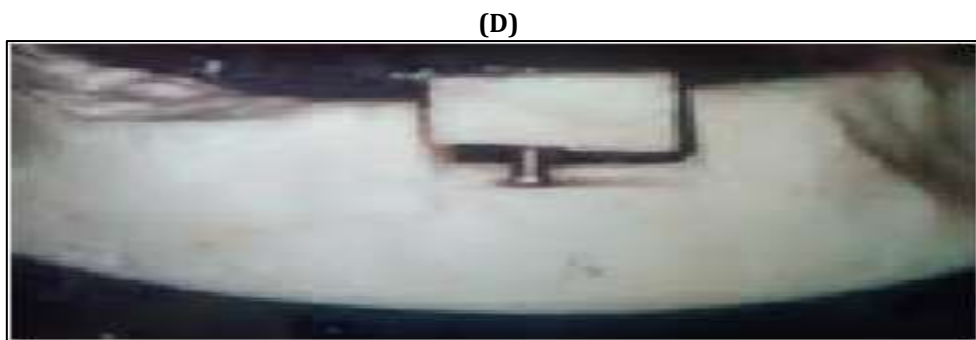
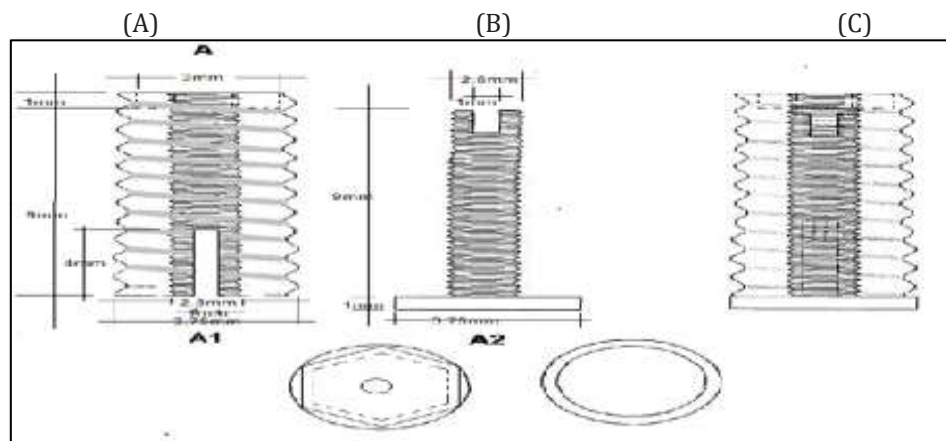
A reliable, practical, simple and versatile device is sought, which will always produce the satisfaction of use for the operator and well-being for the patient.

Next, a distractor available in the market is illustrated (Stryker Leibinger Co).



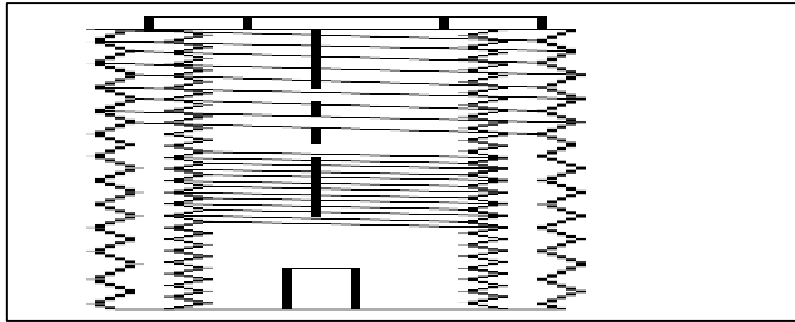
The current state of Dentistry obliges not to subject the patient to pain and load of two and up to three interventions: one for the placement of the Distractor and another for the removal of the same. (This is not good). The implants for rehabilitation should be placed in a third time. The most skilled operating surgeons will try to avoid this third operation when trying to place the implants when removing the distractor. We must avoid producing unnecessary burdens because we could be frowned upon by colleagues and patients. On the other hand, the existing distractors in the market are very bulky

with an outgoing element to the oral environment and therefore extremely annoying, prone to shocks and unwanted movements harmful to the distracting process and interfere with mastication and phonation. If instead of two or three operations we use one, it will be a great development of the technique and dental technology. This device is positioned exactly the same as a conventional implant and will be placed in the mobile portion of the bone that we want to level. Below drawings of our design:



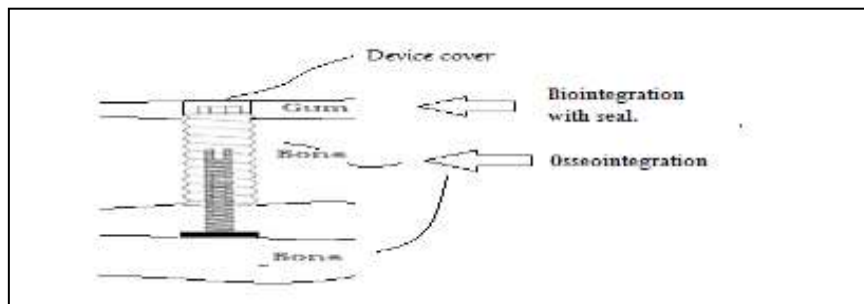
The designed device resembles a hollow implant (A) that will house a drive screw (B) and (C). The drive screw (B) rests on the basal bone and elevates the bone block that has been cut. Interest leveling for proper rehabilitation. (D). Once an adequate dimension of the resorbed alveolus is

achieved, the same device becomes an implant to place the oral rehabilitation abutment. The device is the same as a hollow implant. As an implant it has an external thread. It also has an internal thread. The size and diameter is the same.



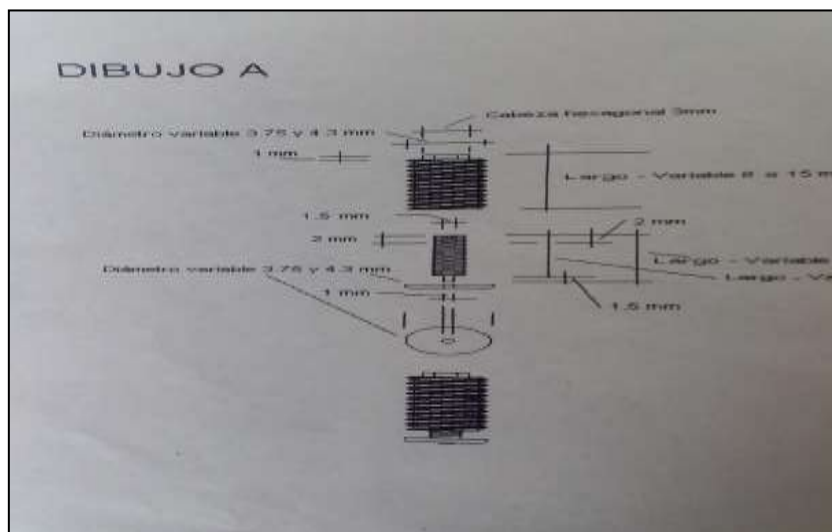
The drive screw is housed inside the hollow implant and is rotated to move it longitudinally causing distraction. The impeller ends in a polished disc that supports the basal bone as its displacement occurs telescopically outside the hollow implant. This disk can be independent of the drive shaft.

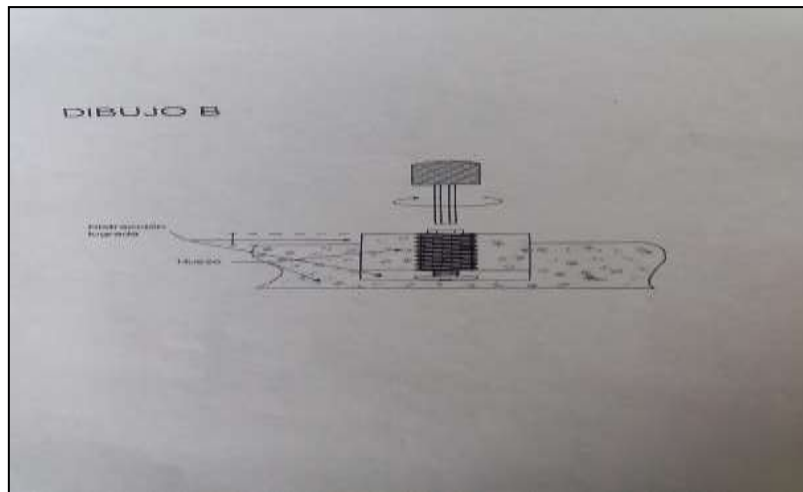
The results will be visible in the oral cavity. A flange that has been lifted to achieve leveling and to perform oral rehabilitation. It is at this time device becomes an implant to be much longer and able to have enough space to accommodate any type of abutment that we consider appropriate for our rehabilitation.



Note that our device will be placed slightly protruding to the bone surface in order to produce the seal between the gum (Biointegration) and the metal manufacturing it so that together with the top

cover, it cancels the contamination. When the device is in contact to the bone, "Osseointegration" is achieved.





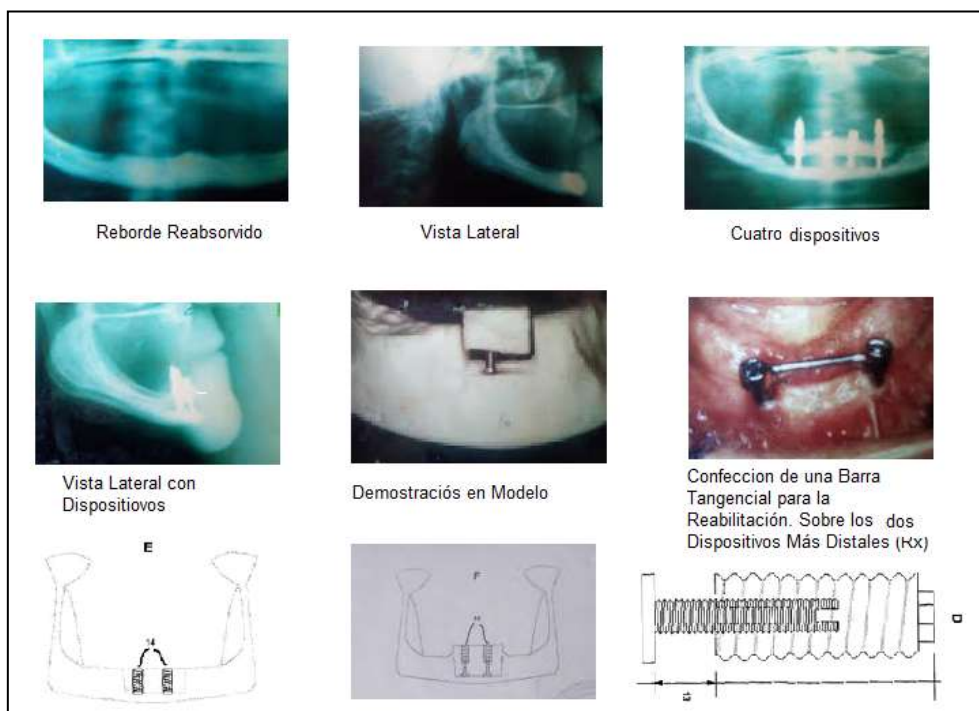
In these two drawings we can see how our device acts. In (A) the parts of which it consists, you can see the polish disc the “Internal” or “Driver Screw” or “Impeller” ends.

(B). The internal drive screw rotates by turning it manually with a special screwdriver that is also manufactured

**Advantages:**

1. The patient will be operated only once. The existing Distraction devices in the world market must be placed first to produce distraction and then the patient must be subjected to the load of a second intervention to remove said device and position the implant of an appropriate size. There may be a third operation to place implants and achieve oral rehabilitation.

2. The existing Distractor is very bulky. Therefore definitely anti-aesthetic and prone to shocks that can hinder the distraction process. It will interfere with the functions of chewing and phonation. We can never control a patient who leaves the consultation.
3. Our Distractor-Implant because it is central in bone, will not be anti-aesthetic at any time, nor will it interfere with the functions of phonation and chewing, will cause immobilization of the socket and will not be prone to blows or harmful movements for the Distractor phase.
4. It will be the same device specially built for the Distractive phase and then for the rehabilitative phase.



The Device is correctly positioned in a patient. Notice the effect it produces. No other device is used for rehabilitation. In this case a tangential bar is made.

## RESULTS

We have achieved a simplified form of treatment by designing a device that saves treatment costs. Although it is not the idea of this work, we can not get in unnecessary expenses, surgical complications and loads,

It alone is oriented towards that objective which is rehabilitation. We want to be clear that we will never spare such treatment costs, this work is about avoiding surgical complications that lead to a psychic state of concern for the patient. It will be good not to subject it t surgical loads. With this device, the treatment steps are reduced and made easier for the operator. Our patient will be very grateful to the power of this type of alternative that is offered.

## DISCUSSION

We have definitely achieved our purpose. We have reduced the steps to reach the final result, which is the complete oral rehabilitation of the patient. We feel that technological progress has been made in our field and we have a greater number of Distractors that allow us to offer the patient more alternatives to achieve the final result in a shorter period of time, which is what really interests him. We do not want to stop recognizing that the Surgeon Operators have also simplified the work to reach the goal. It will be extremely appreciable for both the Surgeon and the patient to know that they will be operated only once to place the Distractor-Rehabilitator device since by performing the two functions the dental work can be concluded in less steps or surgical exercises and less time. We do not want to belittle the benefits of the existing Alveolar Distractor which is available in the World Market, since much has been achieved for many years with it. It is not the objective of this work. The real purpose is to encourage research and find or devise treatment alternatives that we are sure to have obtained.

## CONCLUSION

**With this work it is established that:**

1. A unique device has been produced.
2. A less bulky device has been produced.
3. The aesthetics of the patient is improved.
4. It requires much less care from the patient. Be careful that we can never control.
5. We have achieved a reduction in treatment costs.

6. The steps to achieve oral rehabilitation as a final result have been reduced.
7. We do not subject the patient to the stress load of being operated up to 3 times.
8. The patient will sometimes be an intervention and very simple.
9. The intervention can be of short duration and in cases of having a skilled surgeon, it may be necessary in the dental chair of the office, always taking into account the rules of asepsis and with all the precautions.
10. Biointegration of the construction metal of the Distractor (Titanium) takes place from the first moment, producing the much desired seal of the oral mucosa with the upper surface of the device to avoid any contamination. Osseointegration comes with the contact of bone with the metal. It has to be polished, deionized, clean without any solid particle and neutral from the electric point of view.
11. We have eliminated the word "Adaptation" by not using the existing Distractor that entails an annoying sensation for the patient who must be used to having a foreign body in his oral cavity.

We want to make it clear and establish that it is not the goal of us and this work to criticize and disqualify the distracting devices manufactured by large companies and existing in the world market. On the contrary, we want to recognize the benefits of these devices that have been used for many years. What we want is to improve technologies and present a new treatment alternative in order to have more things to offer to patients and surgeons of the whole world.

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