

# THE CONVENTIONAL METHODS OF BONE IMPLANT RECONSTRUCTION VERSUS THE PIEZOSURGERY TECHNIQUE

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**Abstract:** The conventional methods of bone implant reconstruction through techniques of bone splitting or sinus floor augmentation, feature a series of disadvantages (perforation of sinus membrane, side-slipping of the cutter (milling cutter), bone warming with the appearance of some necrotic areas, higher pressure within the hand piece-instrument), which we will present during this research, highlighting at the same time the importance of using the new technology of piezosurgery in the case of bone osteotomy implants. The technique of osteotomy using the piezosurgery machine is a relatively new method in our country. Although the first research in this domain started in the second period of the 1990s, a highly appreciated development in piezosurgery took place starting with 1996. This growing interest is due to the rising number of clinical research and studies, as well as to the bibliographical abundance, all of these showing promising results on the long run. Thus, this technique allows obtaining a high success rate, superior to other (traditional) surgery methods. These important advantages allow using successfully an ultra-sound technique, as well as reducing the period of intervention and the risks of complications and thus, those of the patient's death. The continuing high demands of patients for the prosthetic-implant treatment in different cases of bone atrophy and world wide acknowledgment of this alternative therapy, implies a deep research on this theme, trying to eliminate the previous failures.

**Cuvinte cheie:** reconstrucție osoasă, piezochirurgie, osteotomie, despicare osoasă, sinus floor augmentation

**Rezumat:** Metodele convenționale de reconstrucție osoasă implantară prin tehnici de bone splitting sau sinus floor augmentation, prezintă o serie de inconveniente (perforația membranei sinusale, deraparea frezei, încălzirea osului cu apariția unor zone necrotice, presiune mult prea mare la nivelul piesei de mână) pe care le voi prezenta în cadrul acestui articol evidențiind totodată importanța utilizării noii tehnologii de piezochirurgie în osteotomiile osoase implantare. Tehnica de osteotomie folosind aparatul piezochirurgical este o modalitate relativ recentă de tratament la noi în țară. Deși primele cercetări în acest domeniu au început în a doua jumătate a anilor '90, o dezvoltare apreciabilă a piezochirurgie a avut loc începând cu anii '96. Acest interes crescând se datorează numărului tot mai mare de cercetări și studii clinice, precum și abundenței bibliografice, toate acestea prezentând rezultate promițătoare pe termen lung. Această tehnică permite astfel obținerea unei rate de succes mult superioare altor metode de chirurgie (convenționale). Aceste avantaje semnificative permit utilizarea cu succes a tehnicii bazate pe ultrasunet, reducând în egală măsură durata de intervenție precum și riscurile apariției complicațiilor și implicit morbidității pacientului. Cerințele în continuă creștere ale pacienților pentru tratamentul implanto-protetic în diferite forme de atrofie osoasă și consacrarea la nivel mondial a acestei alternative terapeutice impune studierea aprofundată a acestei teme, cu încercarea implicită de înlăturare a eșecurilor anterioare.

## Indications and counter indications of the osteotomy techniques and implants insertion

The local and local-regional anatomical conditions must be adequate to allow the insertion of an appropriate number of implants with the right length and diameter.

Both the general and local conditions must contribute to the well functioning of the implant. Before planning the implant treatment, an adequate pre-surgery evaluation of the patient must be performed in all cases.

**The general indications** imply that there is no problem in the well being of the patient so as to perform the surgery for implant insertion. All the changes in the vital signs impose lagging the surgery and monitoring the patient until stable state.

**The counter indications** include the normal ones that appear during the oral surgery, as well as those specific to implants, which seem to correspond to the structural and physiological quality of the bone and mucoperiost.

**Local indications** are represented by edentations, which constitute an indication of election, when we also talk about bone reconstruction techniques along with side implant insertion with a view to the prosthetic-implant treatment.

**The local counter indications** are divided into two main groups: anatomical and pathological, the second one in turn being divided **into definite and temporal**.

**Definite pathological counter indications** are represented by: jaw or mandible (lower jaw) cancer, premalignant lesions (leukoplakia, lichen plan) fibre osteitis,

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dramatically worsen the treatment's outcome, either by affecting the patient's well being or by the modifications they bring about in the bone structure.

**Temporal pathological counter indications** represented by oral cavity aphtha, serpigo, paradental lesions, difficult cavities, perijaw suppuration, minor and restricted osteitic processes, dirty oral cavity, radicular debris, bruxism, allow for the interventions of osteotomy and plant insertion to begin after they have been cured and after the damaging habits have been removed.

### **The evaluation of bone offer and of the anatomical elements that are important in bone reconstruction**

The imagistic evaluation as a method of supporting diagnosis during the implant therapy is useful to evaluate during the treatment of the present hard tissue and for the detection of eventual pathological processes present at the level of the concerned area.

**Retroalveolar radiography** offers precise and detailed information on the investigated area. It is used more rarely in the pre-surgery investigation because it covers a too restricted area of examination; used along with side orthopantomography, it offers precise information on restricted areas.

**Orthopantomography** offers a good overall view about the present teeth, the included teeth, the already existing pathological processes, or that of tumours, the presence of side effects, old anatomical structures, as well as information on the height of the alveolar process, representing thus an indispensable tool during treatment planning. Through the right application of the way in which the image is calibrated in the concerning area, one can perform sufficiently precise measures of the height of the bone from the peri-implant area.

**Computer scanning** offers a multitude of valuable information allowing the evaluation of all parameters of the concerning bone (height, width, length, bone angulation); evaluating the appropriate bone density indicating the width of the bone cortical; visualizing in detail of the anatomical elements which limit the bone offer (the floor of the nasal fossa, of the jaw sinus, the mandible canal, menthionique hole, the incisor canal and submandibular gland fossa); the simulation through special programmes of the insertion of the future implant, with the exact setting of the angulation, length and diameter.

### **Materials and techniques of bone reconstruction**

The main materials capable of stimulating bone neoformation are bone grafts and the biological modellers sculpturing added to bone graft. The types of grafts now used are:

- **autogenous grafts** = grafts taken from the same organism, from endooral or exooral areas;
- **allogeneous graft s**= graft taken from the corps of the same specie.
- **xenogeneous grafts** = grafts taken from other species. Most frequently the bovine source is used. This type of graft needs to be deproteinisaised so as to reduce the antigene reactions.
- **alloplastie grafts** = grafts formed out of synthetic material (ceramic, polymers, composite, calcium phosphate, hydroxyapatite). They can be bio-inert (actionless) forming a mechanical connection with the host bone (ceramic material) or bio-active forming a chemical connection with the host bone (calcium phosphate, hydroxyapatite).

When one requires a particular bone regeneration – guided bone regeneration - it will also be added the **barrier membrane** at the already mentioned materials. There are two major categories of membranes: resorbed and unresorbed.

The main augmentation techniques used today are:

- osteoplasty;
- adding bone grafts at edentation enamels;
- sinus lifting;
- osteodistraction;
- bone splitting;
- transposition of the alveolar nerve.

It has been noticed that through the judicious mixing of more techniques, the desired results can be faster and efficiently achieved.

**Lifting jaw-sinus** consists in the lifting of the sinus membrane of the floor of the jaw sinus and the introduction (insertion) underneath of a bone graft material. Thus, it is obtained a growth in dimension of the available bone of the area. The lifting of the sinus membrane is indicated in lateral, terminal, subtotal, and total jaw edentations, at which the bone height is insufficient for the insertion of implants smaller than 10 mm, being limited by the presence of the jaw sinus.(jaw sinus)

In what concerns the actual surgery, there are two ways of sinus lifting surgery, differentiated by the type of sinus approach: internal sinus lifting and external one. In the case of the internal sinus lifting, the sinus approach is done through the osteotomy of the enamel crown edentated and in the case of the external one, the approach is done through osteotomy of the lateral wall of the jaw sinus. The choice of the two surgical techniques depends on the quantity of the available bone initially presented.

In the case of the external lifting, the osteotomy of the lateral wall of the jaw and the lifting of the sinus membrane can be done by using traditional methods (diamond circular cutter, special manual decolorator, or the piezosurgery technique using special ends both for the osteotomy as for the lifting of the membrane.

**Bone splitting** is a well known procedure in the English literature as splitting osteotomy and it is used for narrow edentation enamels of approximately 2/3 of their height, having in mind the growth of their width, so as to be used in the insertion of some implants of adequate diameters. It can be done along the edentation enamels with the traditional instrument (circular cutters, oscillating saw, graded chisels) or with the piezosurgical instrument, and according to the deficit of the available bone width, it can be applied either before or simultaneously to the implant insertion. In the case of the jaw, osteotomies are required in order to avoid a fracture of the cortical bone. The filling of the resulting bone cavity after bone splitting can be done with granular bone covered or not by the membrane.

### **Piezosurgery technique**

Piezosurgery is a very advantageous osteotomy technique for the delicate structures in the oral or jaw-face areas. It works with precision on the smooth and fragile bones, the ultrasound techniques is superior to the manual-mechanical instruments technique due to a specific precision, easily usable, efficient bone ablation and accidental damage on the structures of the adjunct soft tissue. I think that these are the essential premises to a durable and stable result from the functional and aesthetic point of view.

**The piezo method** implies the use of an ultra-sound machine that works with controlled tridimensional vibrations and is indicative in works of many domains of dental medicine, like oral surgery, implants, parandontology and endodontology. The ultrasound setting of the piezosurgery machine acts through vibrations of high frequency between 24.000 and 29.500 Hz, modulated, of low frequency of 10-60 Hz, thus ensuring a maximum efficiency and control during the operation. The

machine is equipped with two programmes: the “Bone” programme specially conceived to work upon bone tissue and the “Root” programme, for endodontology and parodontology interventions. The peristaltic pump which is attached to the machine and connected with the bottle of physiological serum does this irrigation adjustment.

The instruments of the piezosurgery machine are divided into:

- *cutting instruments*, used in bone sampling, in dental atraumatic extractions and in the making of osteotomies and osteoplastias;
- *grinding instrument* are used in the making of neovalvulars, in the incisions of the bone windows from the sinus lifting procedure, as well as in osteotomies and osteoplastias;
- *instruments that do not cut*, used in the sinus membrane lift, repositioning of the inferior alveolar nerve and in parodontology, in radicular smoothening.

Another classification is based on the colour of the instruments. The gold instruments are mainly used on bone tissue and the silver ones on works that are done on teeth and soft tissue.

In conclusion, the major features of piezosurgery in oral implants are represented by bone grafts sampling, making of bone windows and lifting of the sinus membrane, making of neovalvulars and narrow bone splitting.

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