Minimally invasive implant placement without the use of biomaterials using the bone expansion technique

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The success rate in implantology is close to 96 percent. Thanks to well-established implant placement protocols, with a few differences according to the implant system used, the predictability of the result under optimum tissue conditions is quite significant. It is very different when these conditions do not meet the recognized standards in terms of volume and quality for reproducibility in implantology. For example, thin ridges, which are frequent occurrences, will require a long and costly process for patients because they entail bone augmentation or possibly support tissue grafts.

Is there a minimally invasive alternative for these patients that allows them to be treated without these problems? One line of thinking is to see it is possible to be minimally invasive, precise and also avoid the use of biomaterials simply by exploiting the biomechanical properties of the different tissues.

The general surgical principle of modern implantology, called osteotomy, as close as possible to the dimensions of the implant that will be placed. This principle is still widely prevalent.

However, soft-tissue management has evolved, and the trend the past few years has been to manage soft tissue from the first surgical step. With the arrival of self-tapping conical implants, a new technique was developed that enables lateral as well as vertical bone crestal debridement condensing or expanding. In addition, in 1994, Summers, practicing his crestal sinus lift technique with careful choice of conical taps, was the first to demonstrate the capacity of cancellous bone to be modelled (Fig. 1).

Through two clinical cases, we will see it is possible to be minimally invasive, precise and also avoid the use of biomaterials simply by exploiting the biomechanical properties of bone tissue and its capacity to regenerate. Respecting guided regeneration principles, which means the implant will be placed in physical barrier to isolate the epithelial and connective tissue cells from the operating site, enables regeneration of the different tissues.

These principles are (Fig. 2):
- Primary closure of the surgical site to enable undisturbed and uninterrupted healing
- Completion of the best possible angiogenesis to provide the required vascularisation and undifferentiated mesenchymal cells
- Creation and maintenance of a space to facilitate bone formation inside this space
- Stabilization of the surgical site to induce blood clot formation and facilitate healing

Thanks to the careful choice of the healing screw or the implant abutment/temporary crown pair, these two entities with different regeneration potentials can be hermetically sealed, thereby avoiding cell competition, which we know contributes to the growth of epithelial cells which develop more rapidly.

**Case 1**

The patient presented with a fracture of the 46 (Fig. 3) and periradical cysts. With the patient’s consent, the decision was made to perform an extraction, debridement, socket decontamination and immediate placement of a non-submerged implant (implant and healing screw) using Summers’ method (crestal sinus lift). The patient was on standard premedication with amoxicillin and corticosteroids.

The 46 was carefully extracted by radicular separation to avoid bone fracture especially in the vestibule where the cortical bone is very thin. The lamina dura, which enables the attachment of collagen and Sharp-Ey’s fibres, presents a high potential for contamination. Consequently, a light manual curette of the socket was carried out, followed by a superficial debridement (vasopression) of the entire ‘lamina dura’ with an Erbium laser (2.940 nm) followed by decontamination with a diode laser (940 nm).

This was a flapless surgery. The expansion osteotomy was performed through the inter-radicular septum. It was initiated with a very thin manual bone tap (pointed) and then an automatic mechanical osteotome (Figs. 4-5) (Osteo Safe®-Anthogyr) was used. The use of convex inserts in the beginning enables lateral expansion of the native or healed bone and then concave inserts during the breaking of the last sub-sinus millimeter enables lateral bone recovery of this bone socket while protecting it apically.

During sinus progression PRF membranes (or native collagen membranes) are placed in the osteotomy opening to fill the intra-sinus space that is thereby gained (they also provide protection of the sinus membrane).

The Erbium laser is again passed through the osteotomy socket to vaporize the bone debris and sludge along the walls of this osteotomy. The implant is placed according to the manufacturer’s recommendation but with an even slightly higher torque if the titanium grade so allows. A healing screw that fits the diameter and height of the residual gap to be closed is carefully chosen (Fig. 6).

If the healing screw does not enable primary closure of soft tissue, PRF membranes are used to fill the gap. If this gap is too big, a mucoperiosteal detachment of 6-10 mm and then a horizontal incision of the peristium of 6-8 mm are made. This technique serves to pull the gum around the healing screw by maintaining it with two sutures. The control X-rays clearly showed good osseointegration of the implant, significant filling and regeneration in only three months, and then perfect filling and regeneration four months after surgery.

The bone remodeling around and above the implant neck also seemed...
to be well executed. The cone beam 3-D imaging in the first place showed a healthy sinus without inflammation or infection as well as bone re-modelling at the apex and around the implant (Fig. 8). In the case of a trans-alveolar sinus lift combined with the placement of an implant by bone expansion, convex-tipped inserts should be used first to enable lateral expansion, and then cone-face inserts enable scraping of the bones of the lateral walls of the osteotomy to enable apical projection after breaking the last millimeter under the sinus floor. If a mandibular implant is to be placed completely in native bone, convex inserts sufficient. The last insert that is placed is smaller in diameter than the implant that is chosen.

The advantage of this technique was noted starting in 1990 by Summers himself with the use of concial osteotomes as opposed to cylindrical os-teotomes, which were all that were available up until then. The idea was actually to enable lateral peri-implant bone condensation in order to increase notably, primary stability and compensate for the lack of vertical dimension of the sub-sinus native bone.

The objective of this technique is to maintain, if possible, the entire maxillary bone by laterally pushing back the bone with minimal trauma while creating a precise osteotomy that breaks the last millimeter of the sinus floor while protecting the si-nus membrane. The consequence is the notable increase in peri-implant bone density with a high elevation of BIC (Bone Implant Contact) and, therefore, bone stability.

Case 2

The patient presented with a fracture of #24 with significant periodontal involvement (Figs. 3-5). It was decided that an extraction would be performed with immediate placement and loading of an implant after complete decontami- nation of the extraction socket using lasers (Figs. 11, 12). Next, Osseosafe was used (Fig. 13) to enable gentle trabecular expansion and placement of a self-tapping conical implant (Anatomic FX® Anthogyr). In this case, where bone recovery along the osteotomy walls was not necessary, only convex inserts were used. The palatal and subungal portion of the implant is respected (Fig. 14). The gap between the implant and the vestib- ular cortical bone is not filled. Care- ful choice of the implant abutment and its position is crucial both in terms of hard tissue and soft tissue. The temporary crown is thereby shaped in such a way that it closes the gap by slightly compressing the marginal gum (Fig. 15).

It is mounted out of functional oc- currence. Of course, the patient was advised to avoid voluntary chewing on this implant and only use local cleaning with cotton soaked in chloro- rhexidine.

Following verification of the osse- oointegration (Fig. 16), the impression was made eight to 10 weeks after sur- gery, followed by placement of the permanent prosthesis (Fig. 17).

Conclusion

The implant placement technique with the use of osteotomes is not a new concept. On the other hand, using an automatic osteotome pro- vides a better view of the site and makes it possible to practice flapless surgery, to position more precisely and obtain more homogeneous progression, in comparison to us- ing bone taps with a surgical mill. From the patient's perspective, sur- gical comfort is significant and very noticeable.

A follow-up timeline is essential to allow for interventions if signs of complications appear. In such cases, the expertise and training of endo-odontists becomes important. Diag- nosis, preventing and treating any pulpal complications are an integral part of endodontic training as well as performing pulp regenerative proce- dures and treating inflammatory root resorption (Figs. 8a & b).

Vital importance is attributed to the closure of soft tissue during implant placement, either by carefully choosing the healing screw (the height and diameter) or the implant abutment, enabling slight compression of soft tissue and providing a high level of peri-implant prosthetic connection system with a ‘barrier’ that enables the regenera- tion of the two families of tissues.

These minimally invasive tech- niques still require many improve- ments and new widespread valida- tion. However, for ethical and safety reasons, the practitioner should al- ways suggest the least invasive tech- nique that contributes to, guides and induces this tissue regeneration for which, most of the time, we have the matrix around these traumatized zones.

References


Editorial note: The full list of referec- es available from the publisher.

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Dr Gilles Chauvinat graduated from the University of Nancy in 1983. He has worked in more than 15 dif- ferent countries on four continents. Since 2000, the practice of his field in his country has revolutionized his procedures. His prac- tice is limited to endodontics and implantology in Paris and Venicci, Italy.

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