

Irrio.

Tissue interception in dental
surgery and pre-implant surgery

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leu Blanc Dent is a training, research and innovation company in the field of dental surgery. When we created it in 2019 our wish was to bring a new way of looking at dentistry and to share this undertaking with you.



The purpose of Bleu Blanc Dent is to offer innovative training to all oral surgeons and doctors. Our scientific work will improve the clinical care of patients. Innovation is at the heart of our approach so that today's challenges may become tomorrow's successes.

Implantology was born in 1981 and the evolution of knowledge has really revolutionized our practices.

In 2022, progress in the digital field made the classic plaster models of our patients obsolete through the arrival of ever more powerful digital models.

The therapeutic solutions made possible today thanks to implantology are beyond dispute and the prosthetic rehabilitation of our patients must remain the one and only aim of our treatments.

In this context, in 2021 Bleu Blanc Dent set up a research and development institute that is one of its kind: IRRIO which stands for Institut de Recherche pour les Réhabilitations Implantaires en Odontologie. (Research Institute for Implant Rehabilitation in Dentistry).

The IRRIO, in partnership with Bleu Blanc Dent and the industry, takes part in research and innovation in the field of implantology. The expertise of our team is merely the result of the pooling of our knowledge.

The research work of the IRRIO is focused on implant restorations as well as the development of less and less invasive surgical techniques. The purpose is to allow an ever more efficient prosthetic rehabilitation of our patients.

The IRRIO will enable dental surgeons the world over to share and acquire cutting-edge expertise.

Docteur Bertrand BAUMANN
Dental surgeon
Président of Bleu Blanc Dent
Founder of the IRRIO

Scientific research realized at the Research Institute for Implant Rehabilitation in Dentistry

Journal written in collaboration with Professor Marc Engels-Deutsch, CHR Metz-Thionville

Clinical work carried out by Dr Bertrand Baumann
Exercise in implantology and pre-implant surgery,
Sultz (Haut-Rhin)FRANCE

Exercise in implantology at the Albert Schweitzer Hospital, Colmar, FRANCE



In odontology, there is general agreement on tissue preservation. In dental surgery, the preservation of bone volumes is key. One must keep this in mind when performing surgery on maxillary and mandibular

bone structures. Intervention in the buccal area must not jeopardize possible reconstructive surgery or an implant and prosthesis rehabilitation. Intervening on the maxillaries without taking into account tissue preservation is no longer validated by established scientific knowledge.

This is what we had in mind when we chose our clinical research areas at the IRRIO. The aim is to propose clinical alternatives the practitioner may choose from to guide bone healing during surgical interventions in order to avoid mucosal intussusception on the operating site. Several operating approaches will be suggested and detailed but tissue interception during healing will be the common vector of our operative procedure.

Could realizing a bone flap to be repositioned at the end of the operation as in the case of an autogenous graft allow an ad integrum reconstruction of bone volumes? Could the use of resorbable collagen membranes permit to guide healing as does an autogenous bone? Thanks

to current medical imaging techniques and knowing the therapeutic options at our disposal today, can we still imagine realizing bone surgery of the maxillaries without guiding or anticipating the healing of the operated site?

Tissue interception with bone flaps

A surgical intervention on the maxillary bones requires an approach through the cortical level. Unlike the conventional approach consisting in subtractive osteotomy with a round bur under saline irrigation, we realize a bone flap with a diamond blade: thus the bone loss is limited to the width of the blade. Subtractive osteotomy with a round bur entails major per-operative substance loss, remote bone resorption, lack of support for soft tissues during the repositioning of the flap and tissue intussusception in the empty bone cavity during healing.

The preservation of the cortical bone thanks to the bone flap realized at the outset of the intervention along with its repositioning at the end of the operation guarantees optimal tissue conservation. It provides a physiological barrier to guide mucosal healing, allows to protect the underlying trabecular bone and thus avoids any bone volume loss by gingival tissue intussusception.

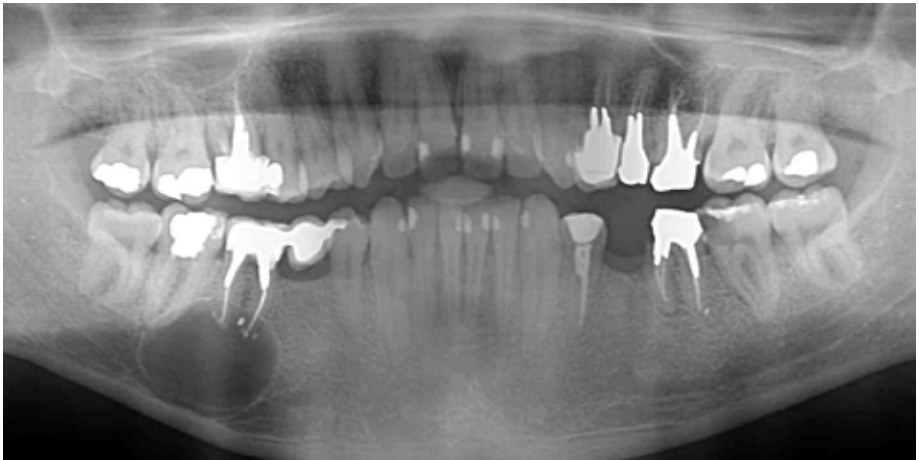
TISSUE INTERCEPTION WITH BONE FLAPS

CLINICAL SITUATION N° 1

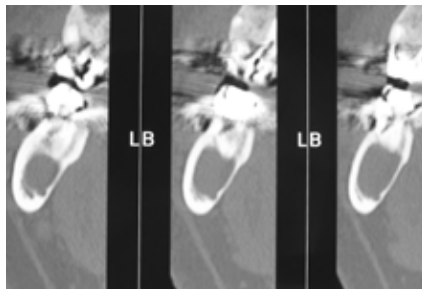
This first 45-year-old patient, without previous medical conditions, was sent to us after a 25 mm voluminous cyst was incidentally found under tooth 46.

A second-line scan was carried out in order to make out the anatomical relationships between the mandibular cyst and the inferior alveolar nerve.

The observation of the scan images revealed a continuity between the cyst and the inferior alveolar nerve. We decided to realize an intervention under general anesthesia to allow avulsion of tooth 46 and removal of the corresponding mandibular cyst. In this clinical context, the patient was informed of the risk of post-op temporary paresthesia.



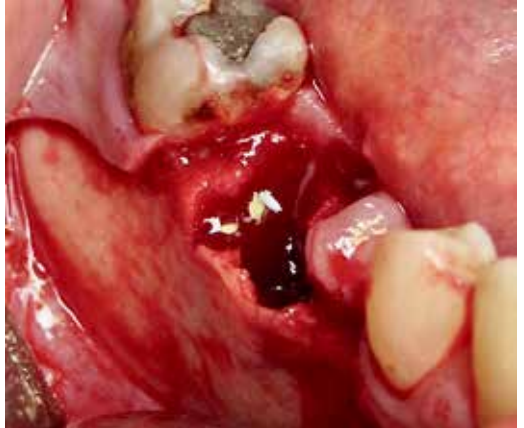
Picture 1: Initial panoramic X-ray



Picture 2: Mandibular scan views of tooth 46



Picture 3: Pre-op clinical situation



Picture 4: Per-operative clinical situation after removal of tooth 46



Picture 5: Osteotomies with Microsaw. Lifting of vestibular bone flap



Picture 6: Enucleation of the whole cyst and dissection of inferior alveolar nerve



Picture 7: Osteosynthesis of bone flaps taken on the site



Picture 8: Healing of site 18 months after operation



Picture 9: Follow up panoramic x-ray 18 months after operation

Through this first clinical situation, we can observe that repositioning a bone flap at the end of the operation allows to guide the healing of the site. Realizing a bone flap from the outset allows a wide passage without risking a potential tissue collapse during the healing process. This approach gives the surgeon a more comfortable visual and technical access to safely realize the dissection of the inferior alveolar nerve.

Repositioning the vestibular cortical and closing the empty alveolar cavity with the cut bone flap allows to reconstruct a bone box in which the differentiation of the blood clot into bone tissue will be made possible without mucosal intussusception.

Thanks to this minimally invasive surgical approach, it is now possible to plan an on-site implant rehabilitation without any remodeling.

CLINICAL SITUATION 2

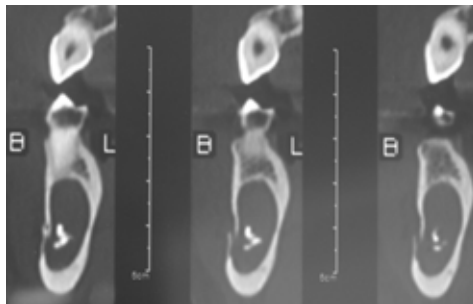
In this second clinical situation, we have a 42-year-old patient, without previous medical conditions, who was sent to us after a voluminous mandibular cyst of more than 40 mm was incidentally found under teeth 33 to 37. A second-line scan was carried out in order to make out the anatomical relationships between the mandibular cyst and the inferior alveolar nerve.

The observation of the scan images revealed a continuity between the cyst and the inferior alveolar nerve. In this clinical context, the patient was informed of the risk of post-op temporary paresthesia of the chin and lips.

For this second patient, we planned a very conservative approach. The removal of the 5 teeth next to the mandibular cyst together with the cyst enucleation would have caused catastrophic bone damage on the operative site.



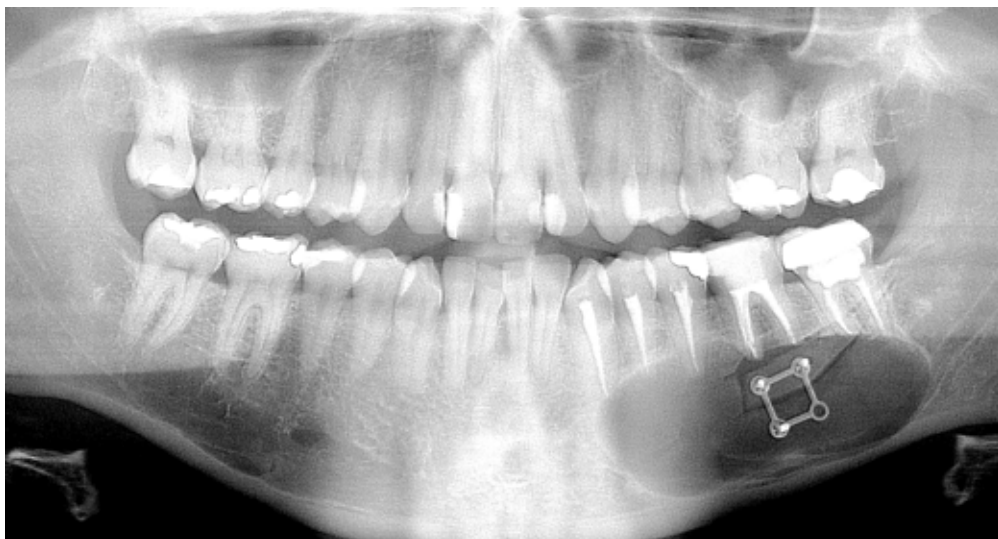
Picture 1: Initial panoramic x-ray



Picture 2: Mandibular scan slices of teeth 34-35

It would have resulted in an extreme fragility of the horizontal left ramus with a high risk of post-op fracture and a complicated osteosynthesis in case of a trauma. On the prosthetic level, the only solution would have been a removable partial denture on a metallic frame which would have allowed the rehabilitation of the edentulous sector. The reconstruction of the site with bone grafts would have required very invasive surgical techniques which might have resulted in failure and numerous tissue remodeling interventions.

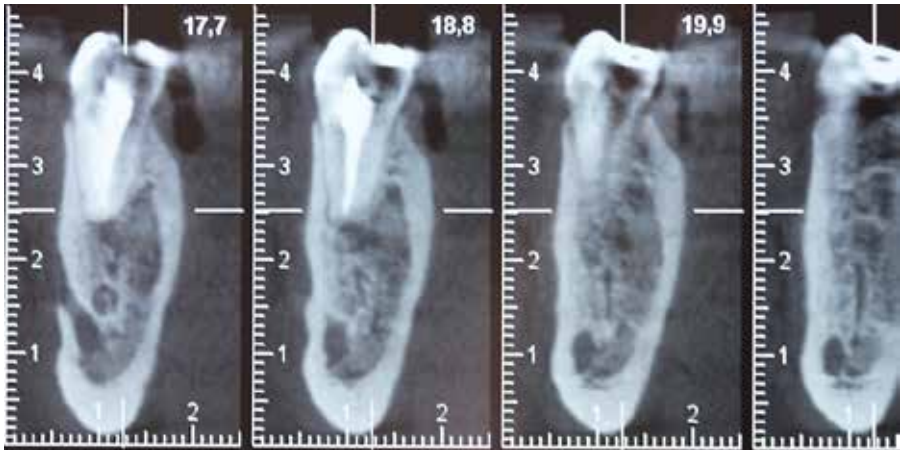
This is why, for this second patient we planned an extremely conservative approach. First we did endodontic treatment on teeth 33-34-35-36-37 linked with the cystic lesion, then we decided to enucleate the mandibular cyst under general anesthesia.



Picture 3: Immediate post-op x-ray



Picture 4: Follow up panoramic x-ray after 24 months



Picture 5a: Scan slices next to 44. Healing after 24 months



Picture 5b: Follow up scan slices next to 34-35-36-37 after 24 months



Picture 5c: Follow up scan slices after 24 months next to apex of 34-35-36-37

After realizing a vestibular bone flap with the Microsaw, we enucleated the whole mandibular cyst and dissected the inferior alveolar nerve with an operating microscope. (No individualization of the inferior alveolar nerve was visible on the scan slices). Endodontic surgery was realized on teeth 36 and 37 with MRI retrograde obturation. At the end of the operation, the bone flap was repositioned, then a titanium plate was placed for osteosynthesis. The remineralization of the bone cavity by successive apposition of bone is done centripetally. Due to the size of the patient's cyst, we waited for 24 months before we did another follow up scan. It is interesting to note the complete healing of the vestibular cortical on all the slices. Through this second clinical situation, we can judge the capacity of the bone tissue to heal. The flap which was cut out before the operation then repositioned at the end of the intervention guided the healing process of the site. Thanks to this technique of tissue interception, it was possible to reconstruct all the bone volumes which had been damaged by the evolution of the cyst. The five teeth above the lesion were preserved and they were not compromised by our surgical gesture

CONCLUSION

Tissue differentiation of the blood clot in bone tissue requires more time than epithelial migration allows. Repositioning the bone flap in fine acts as biological barrier, guides the healing process of the bone and stops the mucosal intussusception which is usually observed.

Thus, making a bone flap allows a very conservative approach which preserves hard tissues without any impact on the mucosa.

In this way the surgical act comes as a step in the overall treatment and no longer as an impediment that might compromise prosthetic or implant rehabilitation. Intervention on bone and mucosal tissues may therefore be planned from the start without compromising the rest of the treatment.

OTHER CLINICAL SITUATIONS



Picture 6: Fixation of bone flap with 2 T-shaped osteosynthesis plates



Picture 7: Fixation of the cortical bone flap of the sinus wall with absorbable stitches.

TISSUE INTERCEPTION WITH ABSORBABLE COLLAGEN MEMBRANES

The impressive progress of science in the area of biotechnology allows us to make more and more efficient absorbable collagen membranes. Realizing a bone flap is not always feasible. Thanks to our clinical research, we will show that it is now possible to use absorbable collagen membranes in order to guide bone healing and prevent mucosal intussusception.

CLINICAL SITUATION 3

In this new clinical situation, a 32-year-old patient, without previous medical conditions, was sent to us after the discovery of a symphyseal cyst.

In spite of his dentist's endodontic treatment of teeth 32-31-41 the situation showed no sign of improvement.



Picture 1: Initial panoramic x-ray

The study of the 2D x-ray did not allow to visualize the limits of the evolution of the cyst. A second-line scan was made to assess the extent of the symphyseal cyst as well as its anatomical relationships with the incisive canine group apex.

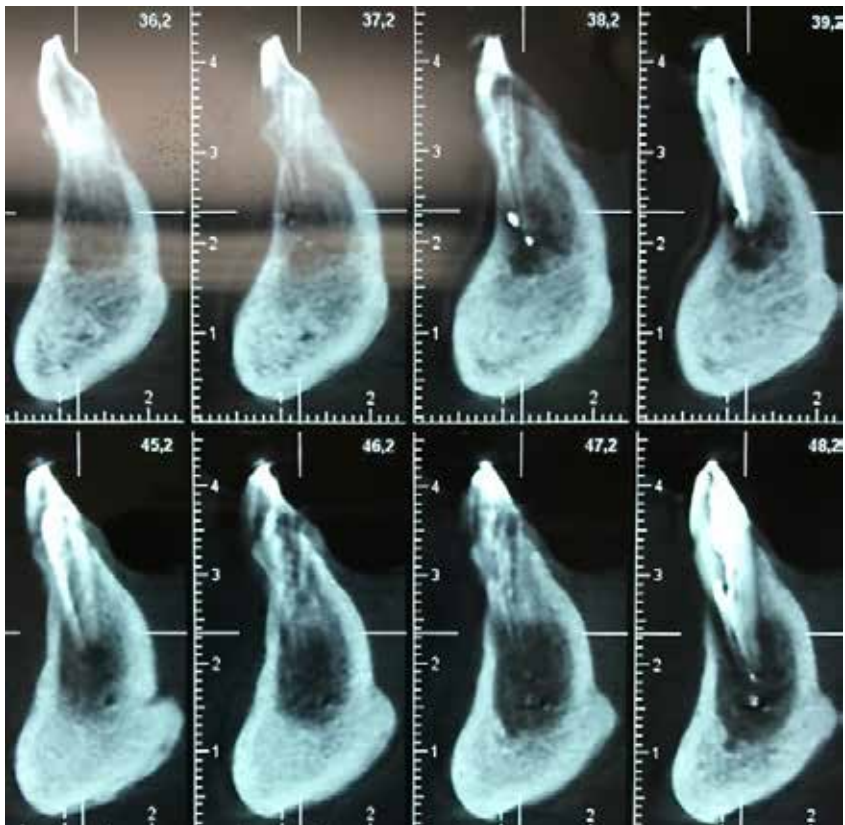
Given the cyst lesion in the symphyseal bone, we decided to perform endodontic surgery under a microscope.

Given the radicular proximity of the nearby healthy teeth, we did not realize a bone flap. Our approach was first conventional, using subtractive osteotomy with a round bur.

The enucleation of the cyst had to be meticulous and thorough in the whole bone cavity. The inter root spaces had to be monitored with a mini-CK6 to avoid the persistence of residual cyst in the cavity, thus preventing the risk of relapse.

We systematically made an anatomic-pathological examination at the end of the operation to detail the histological nature of the resection specimen. This is a medico-legal responsibility.

At this stage, the bone cavity was left empty. The collagen membrane covered the only blood clot that formed in the cyst cavity. The flap was then repositioned and stitched.



Picture 2: Scan slices of teeth 31 and 32



Picture 3: Initial clinical situation



Picture 4: Realization of a full-thickness mucoperiosteal flap of teeth 32-31-41.



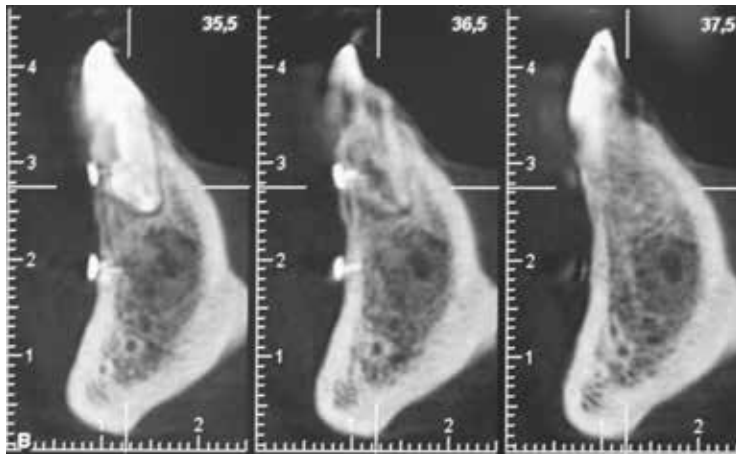
Picture 5: Endodontic treatment by retrograde approach under an operating microscope.



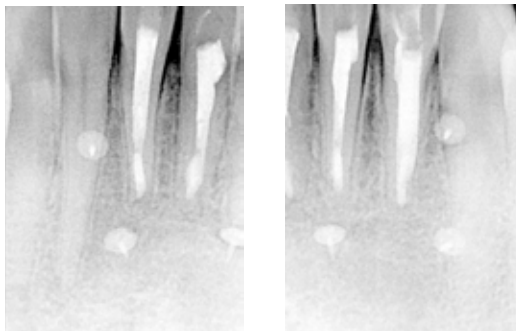
Picture 6: Positioning of an absorbable collagen membrane on the bone cavity. It was fastened with five nails.



Picture 7: Immediate post-op panoramic x-ray



Picture 8: Post-op control x-ray after 6 months



Picture 9: Post-op follow-up retro-alveolar x-ray after 24 months.

6 months after the operation the site was completely remineralized. The cortical grew back on the vestibular side.

At the post-op examination after two years, the symphyseal bone on the operative site was completely restored. The teeth 32-31 and 41 were preserved and no root resorption was to be seen.

Through this clinical situation, we can judge the capacity for tissue interception of cross-linked porcine resorbable collagen membranes. The interposition of the membrane allows, just like the bone flap, to block mucosal intussusception in the empty bone cavity. To do that, it is necessary to use slow rate resorption membranes. In this case, the membrane acted as a 4 to 6-month biological barrier.

The resorption rate of cross-linked collagen membranes advertised by the manufacturer is between 4 and 6 months. Yet, without opening up the sites again it is hard to assess the persistence or the level of degradation of our membranes. In the case of allogeneic bone grafts in pre-implant surgery (with a graft from a live donor), it is recommended to completely cover the osteosynthesized graft with a resorbable membrane. That's why we used the same membranes for allogeneic bone grafts. It is interesting to note that 6 months into the healing process, when we reopened to place the implants, the membrane was still there and intact. Removing it by mere finger pressure allowed to eliminate what was left of the membrane to expose the restored bone site.



Picture 10: Patient A: We reopened the grafted site with an allogeneic graft.



Picture 11: Patient A: Placement of 4 implants on the grafted site after removing the membrane.

The tissue interception realized with a cross-linked resorbable collagen membrane on the grafted site allows to prevent the intussusception of epithelial cells in the allogeneic bone but does not affect the quality of the underlying ossification.

The use of a resorbable collagen membrane has several advantages:

- It does not impede the vascularization of the oral mucosa which covers it; there is no risk of necrosis as in the case of non-resorbable membranes.
- No re-intervention is necessary after the healing process to remove the non-resorbable material.
- In the case of minimal exposure of the resorbable membrane, re-epithelization of the site is often observed. On the other hand, with

non-resorbable membranes, even minimal exposure necessitates re-intervention to remove the material.

After 6 months, the quality of the bone was good, completely vascularized, thus allowing us to place the implant with excellent primary stability.



Picture 12: Patient B: after 6 months, reopening of the grafted site covered with a resorbable collagen membrane.

The site was completely ossified with excellent vascularization of the bone tissue. The epithelial cells of the oral mucosa had not invaded the graft, which would have led to a fibro-osseous tissue.



Picture 13: Patient B: Placement of 4 implants on the grafted site after removing the collagen membrane.

CLINICAL SITUATION 4

Tissue interception allows to push back our surgical limits. It is thus possible to rebuild complex bony defects.

In our next clinical situation, we are faced with a 43-year-old patient without previous medical conditions. She was sent to us for a replacement of tooth 16 and an implant placement.



Picture 1: Initial panoramic x-ray 6 months after removal of tooth 16



Picture 2: Pre-op clinical situation



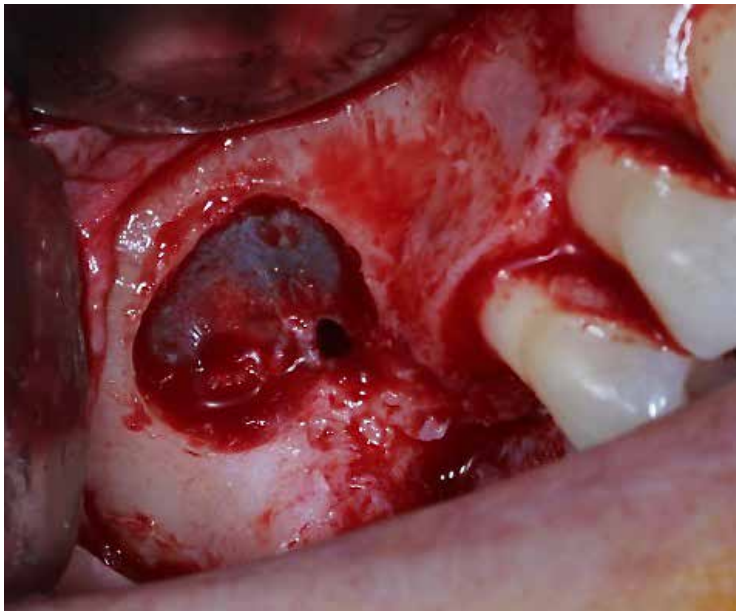
Picture 3: Realization of a full-thickness muco-periosteal flap on the vestibular side.

A vertical bony defect was visible on site on the alveolar ridge but also a large sinus. In these conditions, an implant placement could not be planned directly. We decided to realize an autogenous bone graft combined with a maxillary sinus lift from a lateral approach. The implant placement was put off by 6 months to allow for a good ossification of the reconstructed site. Clinically speaking the oral mucosa showed no anomaly. Even under pressure, no flange was visible

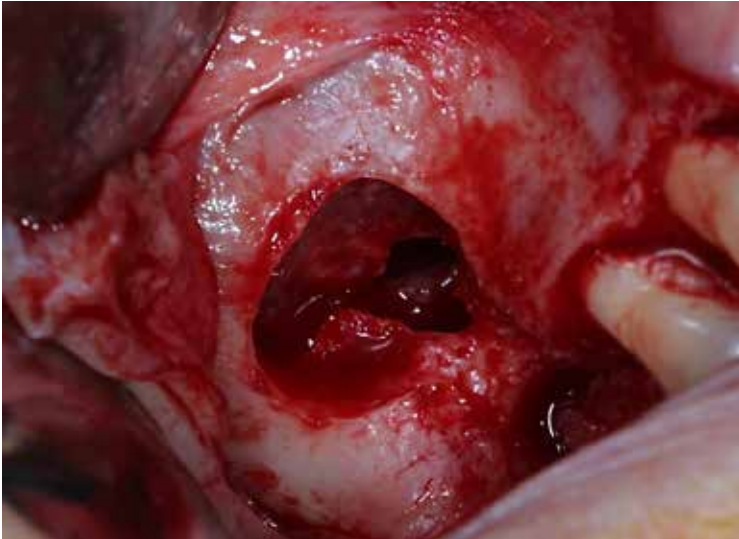
When we lifted the full-thickness muco-periosteal flap, we discovered a continuity between the oral mucosa and the sinus mucosa. The healing of tooth 16 after the extraction did not allow to keep the continuity of the vestibular cortical. As a result there was a communication between the oral area and the sinus.

During the realization of the vestibular bone flap, it was essential to preserve the integrity of the sinus membrane as thin as it might be. The osteotomy was realized with a round bur.

The cross-linked resorbable collagen membrane allows the sealing of the sinus membrane. So, the filling material used to realize the sinus lift cannot escape into the sinus cavity. Exposing the collagen membrane in the sinus cavity at the drilled area poses no risk. The lifespan of this kind of membrane is 3 to 5 weeks, which is ample time for the blood to clot on the grafted site.



Picture 4: Sinus lift using a lateral approach on the site of tooth 16



Picture 5: Detachment of the sinus membrane all around the torn area.



Picture 6: Placement of a protection membrane under the sinus membrane to seal the drilled area. Autogenous bone graft on the ridge.



Picture 7: Positioning of the filling material of porcine origin



Picture 8: Positioning of the cross-linked collagen membrane of porcine origin.



Picture 9: Mucosal healing after 6 months

The bone flap realized by approach from the sinus was used to reconstruct the vestibular bony defect.

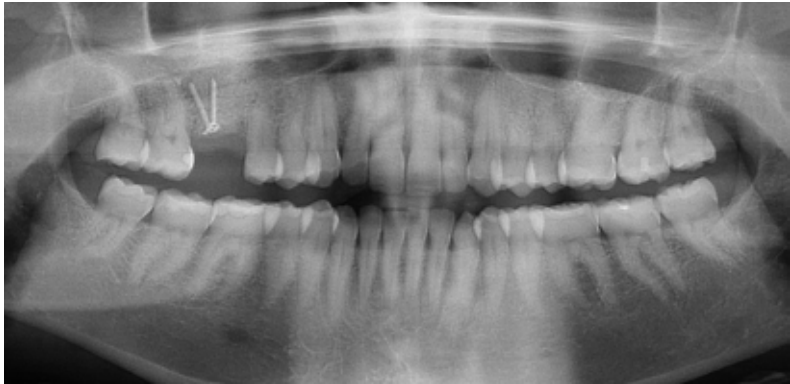
We realized a sinus lift using a lateral approach and reconstructed the alveolar bone with a guided bone regeneration.

The collagen membrane covers the whole site in order to prevent the migration of epithelial cells and guarantee the complete ossification of the grafted site.

After 6 months the healing process on the site was quite satisfactory. The mucosal gingival limit had shifted on the ridge but was repositioned on the vestibular side when placing the implant.

The site was completely ossified with excellent bone quality. The two screws positioned during the sinus graft were hidden under the healed bone. Given the situation, placing an implant was now possible.

Once the screws were removed, we were able to place a 4,5 mm by 13 mm implant with excellent primary stability of 50N.



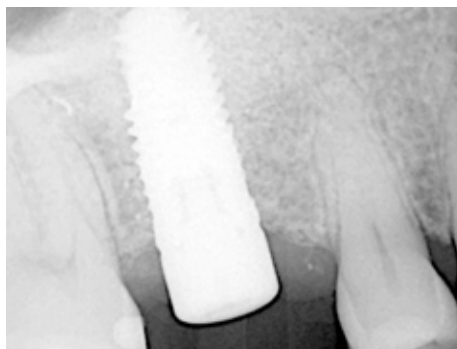
Picture 10: The panoramic x-ray centered on the site 6 months after the sinus graft.



Picture 11: Scan slice after 6 months of healing on the grafted site.



Picture 12: Clinical situation during the placement of the implant 6 months after the graft.



Picture 13: Follow-up x-ray after 3 months of osteointegration.

OTHER CLINICAL SITUATIONS

SITUATION 1 :

The contribution of tissue interception in the management of two sinus walls during the realization of a sinus lift using a lateral approach in implant surgery



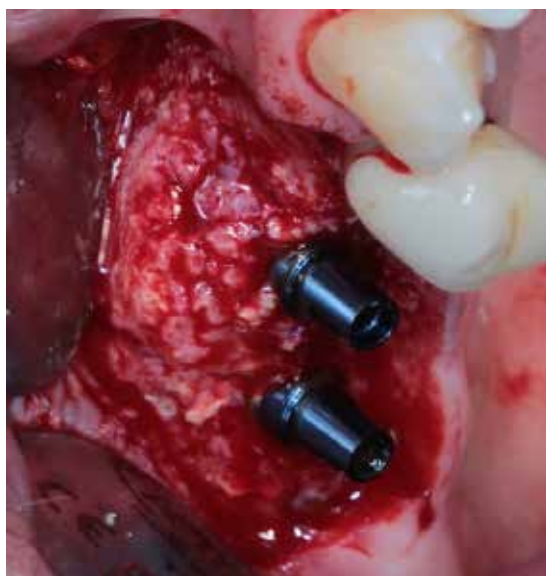
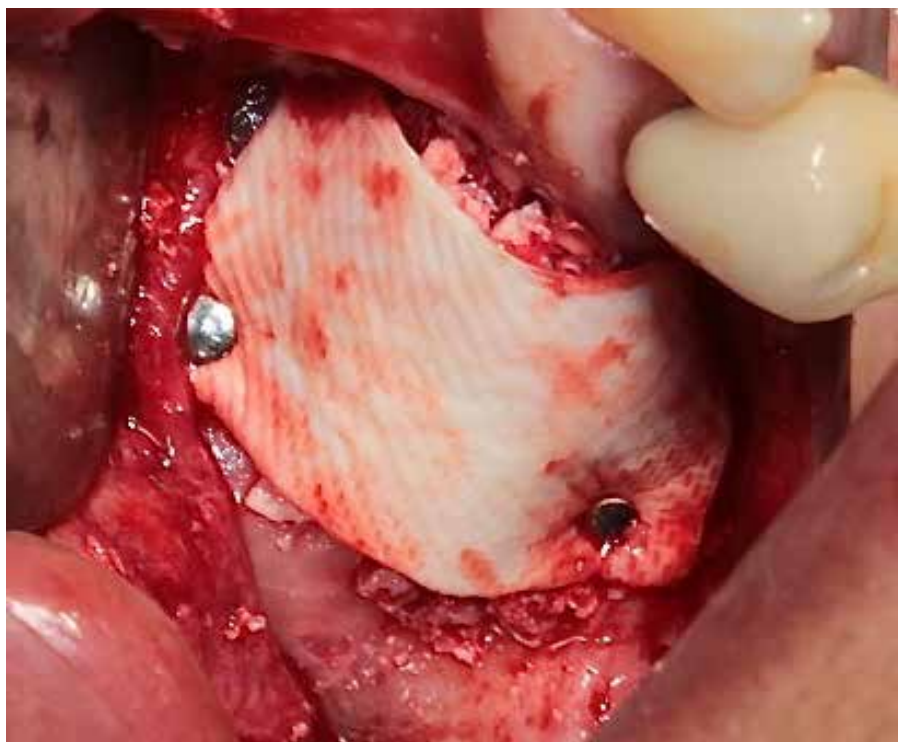
We placed two implants in positions 14 and 15 by endodontic surgery on the mesial root of tooth 16 associated with a sinus lift using a lateral approach in the presence of a sinus wall. The positioning of a collagen membrane from a porcine pericardium allowed to stabilize the biomaterial of the sinus lift but also to guide mucosal healing to avoid a fibro-ossification of the site.

SITUATION 2 :

Pre-implant surgery combining grafting a maxillary sinus, an autogenous bone graft and bone regeneration thanks to the tissue interception process.



We placed two implants in positions 15 and 16 combined with a sinus lift using a lateral approach and an autogenous bone graft with a cortical flap harvested when we accessed the maxillary sinus. A cross-linked collagen membrane was positioned at the end of the intervention to guide the healing process of the operated site and guarantee the dimensional stability and quality of the reconstructed bone volume.



Conclusions

Mastering the biological process of bone and mucosal healing is a prerequisite to a successful treatment. The principles of competition between the mucosal tissue and the bone tissue are the basis of our surgical work.

Oral surgery must be part of this very conservative approach. Today it is possible to master our surgical interventions with a high degree of precision. That's why it is necessary to make the best of our knowledge in cell and tissue biology to apply the operative technique best suited to each clinical situation.

Using an autogenous bone is an excellent work basis because its mere presence acts as a biological barrier by blocking epithelial cells during the whole healing process of the bone tissue underneath. Whenever a clinical situation allows to use the autogenous bone, one should do so.

To press the point further, one could add that evolutions in biotechnology put at our disposal ever more efficient and biocompatible materials. The development of collagen membranes that are more and more responsive to our buccal tissue biology is a real asset for today's clinical practices. When the bone on the operative site is not large enough, it is possible to use cross-linked collagen membranes without compromising bone and mucosa healing. However, we should not push the limits of our clinical practices too far without relying on validated biological principles.



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Surgical treatment of voluminous jaw cyst with a buccal plate : a study of 20 clinical cases

B.Baumann, P.Saez, R.Curien, M.Engels-Deutsch.

Journal of contemporary Dental Practice. 2021 Sep 1;22(9):1069-1075.

Abstract

Aim and objective: The aim of this paper is to present, with a series of clinical cases, some advantages of a modified surgical technique using fixed bone flaps in an approach to voluminous maxillary or mandibular odontogenic cysts (excluding keratocysts) and highlight the positive impact on the healing of mucus and bone tissues.

Background: The surgical approach of the enucleation of voluminous maxillary cysts is generally realized with subtractive osteoplasty. The major problem with this kind of procedure is frequent fibrous healing (or scar formation) of the cavity due to mucosal invagination, especially for large lesions more than 2 cm in diameter. Several techniques have been proposed to limit these side effects. Very contrasting results have been observed in the techniques with graft or exogenous materials, and the scarring effects on mucus and bone tissues are poorly described. In situations where a vestibular cortical bone remains, our modification of the former technique is the use of this bone like a repositioned flap.

Technique: The present study is a case series which was carried out on 20 adult patients with maxillary or mandibular cystic lesions larger than 25 mm. For all the patients, our modified technique consisted of using a bone flap to expose more widely the site and to carry out the enucleation of the cyst. Repositioning the flap in the final stage of the operation with osteosynthesis material allowed controlled mucosal and bone healing confirmed by clinical and radiographic follow-up.

Conclusion: In all cases of our study, no invagination of the soft tissues in the cystic cavity was observed and postoperative bone volumes were identical to the initial state. Only minor postoperative complications were observed in three cases.

Clinical significance: A bone flap approach seems to allow a tissue interception, thus better control of mucosal and bone healing, which is borne out by the clinical and radiographic controls 24 months after surgery.

Keywords: Bone flap; Cystectomy; Odontogenic cysts Oral surgery.