Transcortical anesthesia and implantology

Summary

In the first section, the authors present anatomical, histological and physiological data on transcortical anesthesia; a particularly effective, comfortable, no-risk anesthesia. In the second section, the authors demonstrate all the possible advantages of using this technique in the areas of implantology and pre-implant bone surgery.

Key words: Anesthesia - Transcortical anesthesia - Intraosseous anesthesia - Intradiploic anesthesia - Autologous bone graft - Implant - Graft - Osseo-integration.

Introduction

Each of the traditional anesthesia techniques used in odontostomatology demonstrate certain failures. This requires, to be successful, the use of several successive techniques, which creates an arduous surgical protocol for the practitioner and stress for the patient.

The reasons for these failures can be summarized as follows:

**Periapical:**
Injection too far from the teeth concerned, cortical bone too thick.

**Intraligamentary, Intraseptal:**
Leak of the anesthetic during injection and inability to use an anesthetic with a high vasoconstrictor concentration.

**Spix:**
“Blind” injections which leave success to chance and the presence or absence of mylohyoid nerve afferences (Fig 1).

Transcortical anesthesia was first described by NOGUES in 1907 and is not taught as a technique. It is simply cited as a complementary or selective technique by a working group (“Emploi des vasoconstricteurs en odontostomatologie, recommandations”, Recommendations of vasoconstrictor use in odontostomatologie).
For the practitioner, obtaining complete anesthesia is a source of comfort and enables him to concentrate on other important parts of the implant procedure. Transcortical anesthesia, already used in dentistry and stomatological surgery, benefits implantology by obtaining an ease of operation that is rapid and lasts the length of the procedure without risking the longevity of the implant.

Principles of transcortical anesthesia

Transcortical anesthesia (intraosseous, intradiploic) involves injecting the anesthetic solution into the spongy bone supporting the teeth via the cortical bone.

Anatomical, histological and physiological characteristics of bone tissue:

Anatomically, bone is made up of a cortex forming a dense and rigid envelope enclosing the trabecular (spongy) bone support of the teeth. The trabecular spaces are filled with vessels. (Fig 2).

Its principle and its application make it a technique that could provide a number of advantages to pre-implant surgery.

The whole implant procedure is important; but anesthesia remains the essential step that permits an uncomplicated surgery. Absence of pain right from the beginning of the procedure will increase patient confidence and ensure a certain ease during the rest of the procedure.

Fig 2 - Mandible and maxilla cross-sections reveal the different thicknesses of the cortical bone and the significant volume of space occupied by the vessels.
Histologically, cortical bone (non innervated) is made up of osteons centred on the Havers canals which are in turn, linked to each other by intercommunicating channels allowing exchange between the medulla and the superjacent periostium and vice versa (anesthesia of the lower incisor-canine block by a periapical anesthesia).

Physiologically, the teeth are enclosed in a “box made of bone” (the cortical bone). The trabecular spaces (soft tissue) can receive an anesthetic solution which will immediately envelop the tooth or teeth (depending on the amount injected). This anesthetic solution diffuses from the medulla, via the intercommunicating channels, to the periostium and the attached mucosa.

The characteristics of the transcortical anesthesia are as follows:

- It is instantaneous
- It enables the anesthesia of two, four or six teeth (according to the amount injected) using only one injection, or of the length of the area of bone corresponding to the implant site.
- It enables anesthesia of the attached mucosa around the site of injection.
- It permits the use of anesthetics with a higher vasoconstrictor density with no risk of necrosis.

The slight physiological difference between the mandible and the maxilla (innervation and efferent unidirectional irrigation for the mandible, innervation and afferent pluridirectional irrigation for the maxilla) means that the retrograde effect (spread of the anesthesia distal to the injection point) will be more significant in the maxilla than the mandible (Fig 3).

The thus defined transcortical anesthesia is an instantaneous anesthesia, effective for the duration of an operation (use of an adapted vasoconstrictor without any risk), comfortable for the patient (palatal anesthesia no longer necessary, none or slight anesthesia of soft tissue).

**Clinical aspects of pre-implant transcortical anesthesia**

**Indications**

**Implant Procedure**

Transcortical anesthesia use is a major indication for single or multiple implant procedures in both the mandible and the maxilla,

- **A) Gingival anesthesia**

  It is indispensable before separation of the mucosa covering the implant site. The anesthesia of the mucosa is administered using the same cartridge holder and needle as the transcortical anesthesia. The diffusion of the anesthesia in the mucosal area will be visually controlled and will correspond to the injection zone. In fact, anesthesia of the site by this method will occur through the progressive diffusion of the anesthesia in the mucosal covering and allows for minimal periosteal stripping of the implant zone.

![Fig 3 - "Open" maxilla and mandibula showing a sketch of anesthesia diffusion which is less distal in the mandibula compared to the maxilla.](image)
Intra bone diffusion is carried out by intercommunicating channels to the medulla and the periosteum, therefore, the mucosa tissue does not need to be widely anesthetized as is the case in classic anesthesia. As a result, a reduced volume of anesthetic can be used.

**B) Transcortical osseous anesthesia**

Unlike classic anesthesia procedures in surgical dentistry (interdentary space, ligament) the site in the bone where the implant will be inserted is partially uncovered and can be seen. Transcortical anesthesia (scandicaine 3% without vasoconstrictor) is carried out after anesthesia of a relatively narrow surface of the mucosa.

**Technique**

Before inserting an implant, it is better to find a zone adjacent to the site of the implant in order to avoid a fissure in the bone—albeit one with a very small diameter and without consequence.

Anesthesia administration and the quantity injected are controlled by the Quicksleeper syringe holder. This can be stopped at any moment and resumed on request.

**Clinical procedures for implants**

**In the upper jaw**

The anesthesia is used in all single or multiple implant procedures in the incisor, canine, premolar and molar regions.

The procedure begins with a progressive anesthesia of subjacent mucosa tissue (scandicaine 3% without vasoconstrictor). (Fig 4)

Innervation is from the branches of the superior maxillary nerve (posterior alveolar nerve, middle nerve, anterior alveolar nerve).

Most implants occur in the region from the incisors to premolars and first molars, and rarely in the second molars.

The maxillary bone is composed of a thin cortical wall. The perforation will be made:

- either perpendicular to the wall
- or injection at the top of the ridge, in the molar region where the jugal tissue can impede perpendicular positioning. (Fig 5-6)

(Fig 5 - Transcortical anesthesia at the top of the ridge. Injection of one and a half cartridges of scandicaine without vasoconstrictor.

(Fig 6 - Insertion of 5 Straumann implants. The palatal mucosa has not been separated or anesthetized. Note the weak bleeding.

(Fig 4 - Anesthesia of the central area of the mucosa.
The patient is aware of a gradual numbness in the body of the maxilla which spreads to the palatal wall. Generally, it is not necessary to anesthetize the palatal wall as it is preferable to avoid separating large areas of the palatal mucosa in order to preserve vascularisation of the internal wall.

Complete anesthesia is obtained after the injection of half a cartridge for two implants in close proximity. In the case of four to five implants, a whole cartridge is sufficient after a waiting time of 3-4 minutes for diffusion.

**In the mandible**

The protocol for injection into the mucosa is the same. The same type of anesthetic is used. The perforation of the thicker cortical bone requires a firm hold on the syringe in order for the needle to pass through the bone barrier with precision. In the case of partial edentation, the injection point will be made in the interdentary space where the cortical bone is thinner. Entry into the spongy substance is clearly felt.

Therefore, it is necessary to insert the needle slowly into the bone mass before injecting. Taking into consideration the volume of the mandible and the possibility of contralateral innervations distally, it is advisable to gradually inject a cartridge in a single penetration point. If sensitivity can still be observed or the anesthesia is insufficient, a second injection can be made at another site.

Once again, anesthesia of the lingual mucosa is not necessary because of the diffusion of the anesthesia towards the medulla. (Fig 7-8-9)

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**Results**

500 procedures were carried out between 2001 and 2003; 60 % in the mandibula and 40 % in the maxilla in a sample of 55 % women and 45 % men.
Only three implants had to be removed (mobility\(^1\), absence of osteo-integration in a bone with a density level IV\(^2\)).

In the other cases, clinical and radiographic evolution showed proper osteo-integration.

The quantity of anesthesia used is calculated at approximately one cartridge for three implants at the same site. Anesthetics with adrenaline (scandicaine with adrenaline at 1/100,000) are preferred in extensive sites or if there is considerable mucosal bleeding.

A small quantity of anesthetic ensuring effective anesthesia is beneficial for the elderly and/or polymedicated patients. It is easier to suture mucosal tissue that contains little anesthetic at the end of the procedure.

**Pre-implant graft and bone disjunction indications**

Cases of pre-implant bone grafting under local anesthetic continue to increase, especially in the case of bone disjunction or affixing grafts in the maxilla or mandibula.

It is difficult to maintain a comfortable and effective anesthesia for two hours while affixing a graft.

If the graft can be harvested first, often the site of the graft will also be anesthetized at the beginning of the procedure.

It is often necessary to administer a complementary anesthesia when using classic anesthesia which is harmful in many respects (less effective second and third injections, increased cardiovascular risks, soft tissue filled with liquid).

As transcortical anesthetics remain in situ in the bone mass, the effectiveness of the anesthesia is clearly improved, and a complementary anesthetic is rarely required.

In addition, injection directly into the bone mass does not require a circumferential or locoregional anesthesia which are disagreeable to the patient. Loss of a graft has never occurred as a result of this type of anesthesia. (Fig 10-11-12-13-14).

**Fig 10 - Extraction of tooth 24, which has bone decay.**

*Anesthesia in the interdental bone tissue of the dental neck.*

**Fig 11 - Maxilla and alveolar bone loss will be treated by a mental bone autograft.**

**Fig 12 - A radiofrequency incision of the mucosa in the mental region.**
In the case of a bone deficiency caused by disjunction, transcortical anesthesia obtains a significant level of comfort during surgery. The use of anesthetics that contain adrenaline (scandicaine 1/100,000) limit bleeding in this type of surgery, where oozing from the spongy tissue can be significant, all the while assuring complete anesthesia during the procedure, without, in our experience, negatively affecting the maturation of the remodeled bone site. (Fig 15)

The bone grafts inserted in certain cases of disjunction, had a perfect integration and growth; as proved by return visits and the appearance on scans at 8 months. (Fig 16-17-18)

Fig 13 - Transcortical anesthesia for a corticospongio-mental bone graft harvest.

Fig 14 - Bone graft impacted in the maxillary site

Fig 15 - Mental bone graft from mental osteosynthesis. 3 cartridges are to be used for both the maxilla and mental sites.

Fig 16 - Horizontal mandibular disjunction

Fig 17 - Mandibular disjunction with successive bone grafts
Fig 16 - Vertical maxillary disjunction. One cartridge of scandicaine with adrenaline is used.
III) Treating Complications

The increasingly rare loss of an implant often leads to infections such as peri-implantitis or local cellulitis. Anesthesia of the mucosa tissue is often incomplete and the procedure is painful for the patient. The same applies for the removal of implants where innervation of the granular tissue is dense and hemorrhagic.

Transcortical anesthesia rapidly suppresses pain while eradicating the risk of bacterial dissemination during the injection of a large quantity of anesthetic liquid in the circumferential soft tissue. Use of anesthetics containing adrenaline also significantly reduces bleeding which is quite common in these pathologies. (Fig 19)

Transcortical anesthesia, already widely used in dentistry, seems to us to be particularly well-suited for implant and stomatological surgery. No harmful effects were noted during the osteo-integration or bone grafting process in this study. This anesthesia allows for a safe surgical procedure and an effective and fast acting anesthesia due to its simple and rational use. Further studies need to be carried out in order to corroborate these findings.

Acknowledgements: Dr Julienne CROS –Faculté d’odontologie de Bordeaux (Odontology faculty in Bordeaux, France) and the laboratoire de la faculté de medecine de Bordeaux II (faculty of Medicine laboratories in Bordeaux, France).


Implantologie — november 2004