

# Translated from French

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Continuous education: Diploïc anesthesia

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## Can diploïc (intraosseous) techniques, used in first intention, anesthetize teeth with pulpitis? – A retrospective study of 110 cases.

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### Introduction

Anesthetizing teeth with pulpitis is considered difficult, and is generally performed by adding various techniques, for which it is hoped that their accumulation will enable clinical analgesia: in the maxilla, “tuberosity anesthesia, followed immediately by an intraligamentary and finally an intrapulpal injection as soon as the pulpal chamber is opened”, and in the mandible “regional anesthesia at the mandibular or mental foramen, followed immediately by an intraligamentary and intrapulpal injection as soon as the chamber is open. Never an intradiploïc or intraligamentary injection first: intraosseous and PDL anesthetics alone are unable to solve the problem of the anesthesia in a pulpitis” [5] (p.79). Furthermore, the consensus, among practitioners performing endodontics, is as follows: intraosseous anesthetics (they mean diploïc) used as a supplement to nerve blocks drastically increase the anesthesia success rate for the treatment of teeth with pulpitis. [1], [7] (p.367, p.269-271). We can legitimately wonder whether the anesthetics traditionally suggested as supplemental anesthetics but do lead to anesthetic success, could not, by themselves, ensure the total numbness of teeth.

### Material and methods

110 consecutive patients, 59 men (53.6%) and 51 women (46.4%), average age 45.6 (extremes 10-75 years) with an irreversible acute or chronic pulpitis on a definitive tooth, were subject to a retrospective study in three town based, general dentistry offices.

The differential diagnosis between acute pulpitis and chronic pulpitis was based on the notion of seniority and of recurrence of the appearance of pulpal pain.

### Treatment of teeth with pulpitis

It was performed either by an emergency pulpotomy treatment with access to the pulp chamber and partial pulp removal or by a full scheduled endodontic treatment with a pulpectomy and filling of the complete endodontic system in the same appointment (if the clinical conditions enabled to do so); a local anesthesia

of lidocaine 2% with 1/80.000 epinephrine or articaine 4% with 1/100.000 epinephrine was administered systematically by intraosseous anesthesia (transcortical or osteocentral anesthesia), excluding all other techniques. A complementary PDL anesthesia may have been performed with anesthetic formulations of 1/200.000 adrenaline.

### Description of the anesthetic techniques used

**The transcortical technique** [3]: it consists in placing the anesthetic in the diploe (spongy bone between cortical plates) after having passed through the buccal cortical plate at the mandible. (Schema 1, figure 1). In the maxilla, the access may be obtained from the palatal side.

**The osteocentral technique** [6]: it consists in placing the anesthetic in the diploe by passing through the summit of the septum, in the middle, between the buccal and lingual cortical plates. It requires the use of a special, longer (30G, 16mm) needle (Schema 2, figure 2).

**The intraligamentary or PDL technique** [7]: it consists in placing the anesthetic in the ligament of the tooth. The anesthetic, by passing through the cribriform plate, is in fact an intraosseous anesthesia. (Schema 3, figure 3).

**The anesthesia device which was used is the Quicksleeper**, an injection device enabling the slow injection of the chosen anesthetic solution and the perforation of the cortical plate or the interdental septum in case of diploic anesthetics and allows adequate needle penetration for the supplementary intraligamentary anesthesia, thanks to the needle rotation.

**The main criterion of judgement** was the effectiveness of the diploic anesthesia used alone in first intention to carry on the endodontic treatment that had been initially planned: in case of an emergency treatment, the anesthesia was considered a success if it allowed performing a pulpotomy without the slightest pain. If the full radicular treatment was planned, the anesthesia was considered to be effective if it made it possible to perform a pulpectomy without the slightest pain (not necessarily the definitive canal filling, sometimes impossible to complete, due to apical bleeding, seepage, etc.). Finally, we tried to evaluate whether anesthesia is easier to obtain on teeth with acute pulpitis or chronic pulpitis and whether the lower molars deserve their reputation of difficult teeth to anesthetize.

**The secondary criteria** taken into account were the time necessary to perform the anesthesia, the duration of treatment provided by the anesthesia. Some local medical complications of these anesthetics have been taken into account: gingival or bone necrosis, post operative pain at the injection point.

## Results

One hundred and ten teeth were involved in this study, from which 50 teeth (45.4 %) with chronic pulpitis and 60 teeth (54.6%) with acute pulpitis

### A – Success of diploic anesthesia

Diploic anesthetics used in first intention enabled to complete the planned endodontic treatment in 77.3% of the cases, all types of pulpitis considered. (Table I) The anesthetic formulation that was injected contained 1/100.000 epinephrine in 49% of the patients and 1/80.000 epinephrine for 51% (Table II). In total, in all cases, the quantity injected in first intention never exceeded 1 cartridge, or 1.8mL. The techniques used in first intention were 63 osteocentral injections (57.2%) and 47 transcortical injections (42.8%)

For the supplementary anesthesia, when the diploic techniques proved ineffective, 25 PDL injections were performed. It should be noted that in 6 cases out of 110, we could not perform the root canal filling, for different standard reasons (bleeding, seepage, etc.). (Tables III and IV)

The complements by intraligamentary anesthesia concerned 15 teeth with chronic pulpitis (60%) and 10 teeth with acute pulpitis (40%): the tooth with chronic pulpitis appears to be more difficult to anesthetize compared to the tooth with acute pulpitis. (Table V). Mandibular teeth are not more difficult to anesthetize than maxillary teeth with these diploïc techniques. This element is to be compared with the data quoted by Malamed, indicating that with the IAN anesthesia techniques performed by experienced practionners, the success rate can vary, according to the authors, between 75 and 80% [7] page 228.

It thus could seem that the diploïc techniques enable to overcome the uncertainties associated with anatomy in anesthesia techniques at the mandibular foramen and others linked to the practionner.

### **B – Onset and duration of the anesthesia.**

The average onset time was determined at 2 minutes and 58 seconds: this takes into account the time spent between the first mucosa injection and the moment the syringe is put down. The treatment can be performed immediately. The length of the work duration produced by the anesthesia is on average 36 minutes and 8 seconds, all types of treatment considered.

It is 11 minutes for emergency pulpotomies and 37 minutes 20 seconds for the planned endodontic treatment, all teeth included. No further complement was necessary during the treatment.

### **C – Undesirable side effects linked to the anesthetics.**

No gingival or bone necrosis were observed at the injection point. No vasovagal episodes were observed.

Only a few observations to mention:

- Labial soft tissue anesthesia: 15 cases out of 46 (32.6%)

-Tachycardia felt by the patient during the injection: slight in 31.3% of cases and non existent for 65.7% of patients, when this parameter was taken into account.

## **Discussion**

The duration of the anesthesia obtained being relatively short – however sufficient in this study to enable to perform the planned treatment – imposes a preparation of the therapeutic procedure. The advantage entailed by the immediateness of the anesthesia must be taken advantage of straight away, there must not be any time wasted between the end of the anesthesia administration and the beginning of the endodontic treatment; the practionner must therefore have all of the necessary equipment at hand. The prevision of a relatively long act (programmed root canal treatment of a multi-rooted tooth, long roots, problematic catheterism) entails the obligation to adapt the anesthesia technique especially by considering the increase of the quantity to be injected at the beginning of the treatment (one must absolutely try to avoid reinjection in order to prevent risks of tachyphylaxis) by using an anesthetic solution with a higher adrenalin concentration.

## **Conclusion**

Based on the information gathered throughout this retrospective study concerning the anesthesia of 110 teeth with irreversible pulpitis:

-Diploïc anesthesia (transcortical or osteocentral) used alone as a primary technique allows the endodontic treatment of teeth with acute or chronic pulpitis in 77.3% of cases.

-In the case of insufficiency of the diploïc techniques, a PDL (intraligamentary) supplement ensures the complete anesthetic success in all cases.

- The mandibular teeth do not have a higher failure rate than the maxillary teeth.
- The mandibular molars do not present a higher failure rate than the other teeth.
- It seems that teeth with chronic pulpitis are harder to anesthetize than teeth with acute pulpitis.
- It is the initial pathological status of the tooth which is a predictability factor for anesthesia difficulty and not the type of tooth.
- The very fast onset of diploïc anesthetics makes them the first choice technique for emergency treatment.

This simple observation study on a series of patients is a first step to work out more precise studies bringing forward a higher level of proof. These complementary studies could only be easily carried out in the context of education and research in a university hospital.

Since the publication of this study, the efficacy of first-line intra-osseous anesthesia has been fully confirmed by at least two other studies:

-Remmers et al., In 2008, achieved 87% success (compared with 60% for mandibular foramen anesthesia) in intra-osseous anesthesia with Intraflow, as a first-line treatment, on lower molars with irreversible pulpitis.

-Pereira et al., In 2013 published a study in which intra-osseous anesthesia with X-Tip on mandibular molars with pulpitis gave an anesthetic success rate of 96.8% using articaine 4% with 1/100 000 Adrenaline and 93.1% using a 4% articaine solution with 1/200 000 adrenaline, respectively; The cardiovascular parameters had only a minimal impact.

Ravazian et al. In 2013 published another study showing that intra-osseous anesthesia with X-Tip anesthetized 85% of the mandibular molars with pulpitis, compared with 70% of the teeth with regional anesthesia of the lower alveolar nerve.

So, whether with Quicksleeper, X-tip, or IntraFlow, results perfectly comparable, very clearly in favor of intra-osseous anesthesia compared to the regional anesthesia of the lower alveolar nerve. Added to this are the two notable advantages being the immediacy of analgesia, and the drastic reduction in the anesthesia of soft tissues.

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	<b>Number of cases</b>	<b>Percentage</b>
<b>Anesthetic success</b>	<b>85</b>	<b>77.3%</b>
<b>Treatment possible following complement</b>	<b>25</b>	<b>22.7%</b>
<b>Failure</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>	<b>110</b>	<b>100%</b>

Table1: Data on anesthesia success and failure

Quantity injected (in standard 1.8mL cartridges) expressed in quarters of a cartridge	Number of cases	Percentage
1/4 cartridge	2	1.8%
1/2 cartridge	16	14.5%
3/4 cartridge	14	12.7%
1 cartridge	78	70.9%
<b>TOTAL</b>	<b>110</b>	<b>100%</b>

Table 2: Quantity of anesthetic injected

Treatment performed	Success	With complement	Failure
Full endodontic treatment programmed	80	25	0
Emergency treatment by pulpotomy	5	0	0

Table3: Frequency of the results depending on the acts performed

110 teeth treated	85 by diploïc techniques alone	
	25 with a supplementary PDL anesthesia	of which 1 with a chronic pulpitis
		of which 10 with an acute pulpitis

Table4: Frequency of the results depending on the pathology being treated for the teeth which required a complement.

Half mouth treated	Success		Supplement		Failure	
	number	percentage	number	percentage	number	percentage
Maxilla : 44 teeth	34	77.3%	10	22.7%	0	0
Mandible : 66 teeth	51	77.3%	15	22.7%	0	0

Table 5: Frequency of the results depending on the teeth treated.

## References

- 1-BIGBY J, READER A, NUSSTEIN J, BECK M, WEAVER J. Articaïne for supplemental intraosseous anesthesia in patie 2006;32(11):1044-1047.
- 2- BRONNEC F. L'anesthésie en endodontie. Réal Clin. 2006;17(2):177-188.
- 3-COLLIER T : L'anesthésie transcorticale, technique de première intention. Inf. dentaire.2006;4:125-128.
- 4- DESCORPS-DECLERE J. Pharmacologie des anesthésiques locaux et techniques intra-orales. Les dix points-clés en endodontie 2007 :16-24.

- 5- GAUDY J-F et all. La pratique de l'analgésie en odontologie. Paris : Éditions CDP ; 2005.
- 6- GREAUD P Y, PASQUIER E, VILLETTE A. L'anesthésie ostéocentrale : une nouvelle technique en anesthésie dentaire. Inf Dent 2008; n°14
- 7- MALAMED S F. Handbook of local anesthesia. St Louis: Elsevier Mosby; 2004.
- 8- Remmers  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Remmers%20T%5BAuthor%5D&cauthor=true&cauthor\\_uid=18291275](http://www.ncbi.nlm.nih.gov/pubmed?term=Remmers%20T%5BAuthor%5D&cauthor=true&cauthor_uid=18291275)> , Glickman G  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Glickman%20G%5BAuthor%5D&cauthor=true&cauthor\\_uid=18291275](http://www.ncbi.nlm.nih.gov/pubmed?term=Glickman%20G%5BAuthor%5D&cauthor=true&cauthor_uid=18291275)> , Spears R  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Spears%20R%5BAuthor%5D&cauthor=true&cauthor\\_uid=18291275](http://www.ncbi.nlm.nih.gov/pubmed?term=Spears%20R%5BAuthor%5D&cauthor=true&cauthor_uid=18291275)> , He J  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=He%20J%5BAuthor%5D&cauthor=true&cauthor\\_uid=18291275](http://www.ncbi.nlm.nih.gov/pubmed?term=He%20J%5BAuthor%5D&cauthor=true&cauthor_uid=18291275)> . The efficacy of IntraFlow intraosseous injection as a primary anesthesia technique. J Endod. <<http://www.ncbi.nlm.nih.gov/pubmed/18291275#>> 2008 Mar;34(3):280-3.
- 9- Pereira LA, Groppo FC, Bergamaschi Cde C, Meechan JG, Ramacciato JC, Motta RH, Ranali J. Articaine (4%) with epinephrine (1:100,000 or 1:200,000) in intraosseous injections in symptomatic irreversible pulpitis of mandibular molars: anesthetic efficacy and cardiovascular effects. Oral Surg Oral Med Oral Pathol Oral Radiol. 2013 Aug;116(2):e85-91. <<http://www.ncbi.nlm.nih.gov/pubmed/22841432>>
- 10- Razavian H  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Razavian%20H%5BAuthor%5D&cauthor=true&cauthor\\_uid=23946738](http://www.ncbi.nlm.nih.gov/pubmed?term=Razavian%20H%5BAuthor%5D&cauthor=true&cauthor_uid=23946738)> , Kazemi S  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Kazemi%20S%5BAuthor%5D&cauthor=true&cauthor\\_uid=23946738](http://www.ncbi.nlm.nih.gov/pubmed?term=Kazemi%20S%5BAuthor%5D&cauthor=true&cauthor_uid=23946738)> , Khazaei S  
<[http://www.ncbi.nlm.nih.gov/pubmed?term=Khazaei%20S%5BAuthor%5D&cauthor=true&cauthor\\_uid=23946738](http://www.ncbi.nlm.nih.gov/pubmed?term=Khazaei%20S%5BAuthor%5D&cauthor=true&cauthor_uid=23946738)> , Jahromi MZ. <<http://www.ncbi.nlm.nih.gov/pubmed/23946738#>> X-tip intraosseous injection system as a primary anesthesia for irreversible pulpitis of posterior mandibular teeth: A randomized clinical trail. <<http://www.ncbi.nlm.nih.gov/pubmed/23946738#>> Dent Res J (Isfahan). <<http://www.ncbi.nlm.nih.gov/pubmed/23946738#>> 2013 Mar;10(2):210-3.  
<<http://www.ncbi.nlm.nih.gov/pubmed/23946738#>>