Maxillary nerve block: A comparison between the greater palatine canal and high tuberosity approaches

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KEYWORDS

Oral surgery, Regional anaesthesia, Nerve block anesthesia, Maxillary nerve block.

ABSTRACT

Aim: *Analgesia and anxiolysis during dental procedures are important for dental care and patient compliance. This study aims to compare two classical maxillary nerve block (MNB) techniques: the greater palatine canal (GPC) and the high tuberosity (HT) approaches, seldom used in routine dental practice.*
Methods: *The study was conducted on 30 patients, scheduled for sinus lift surgery, who were randomly divided into 2 groups: the GPC approach to the MNB was used in 15 and the HT one in the other 15 patients. Anxiolysis was also used, depending on the results of the pre- preoperative assessment. Patients' sensations/pain during the procedure, details about anesthesia, and the dentist's considerations were all recorded. Data are expressed as mean ±SD. Statistical tests including ANOVA, χ_2 following Yates correction and linear regression analysis were carried out. A < 0.05 p value was considered significant.*
Results: *Study results showed that the anesthesia was effective and constant in the molar and premolar area. Additional infiltrations of local anesthetics were necessary for vestibular and palatal areas in the anterior oral cavity, respectively, in the GPC and HT groups. The two techniques were equally difficult to carry out in the dentist's opinion. There were no differences in pain or unpleasant sensations between the two groups, nor were any anesthesia-related complications reported.*
Conclusion: *The GPC approach ensures effective anesthesia in the posterior maxillary region as far as both the dental pulp and the palatal/vestibular mucous membranes are concerned; the HT approach did not guarantee adequate anesthesia of the pterygopalatine branch of the maxillary nerve. These regional anesthesia techniques were characterized by a low incidence of intra and postoperative pain, no noteworthy complications, and high patient satisfaction.*

Introduction

Maxillary Nerve Block (MNB) is an effective anesthetic method that experienced dentists should be able to handle with the same skill as an inferior alveolar nerve block. The MNB consists of a single injection that ensures anesthesia to the entire hemi-maxilla, thus permitting dentists to routinely perform invasive dental procedures such as maxillary sinus elevation, zygomatic implant placement and full-mouth extractions, bone cysts removal, and treatment of deep, extensive periodontal and odontogenic diseases of the maxillary sinus (1). It is also used to diagnose and treat chronic oral and maxillofacial pain syndromes. Patients tend to prefer it with respect to other techniques requiring multiple injections, since it reduces physical and psychological trauma, a particularly important consideration in patients requiring anxiolytic medications (2, 3). The maxillary nerve can be blocked using intra or extraoral approaches; the former are carried out by means of the high tuberosity (HT) or greater palatine canal (GPC) approaches; the latter can be performed through the coronoid process of the mandible or through the lateral or zygomatic pathway (4, 5). Intraoral approaches, in particular the HT technique, tend to be more popular with dentists despite the risk of hematoma formation.

The moment when the local anesthetic is injected into the gingiva is the most critical time as far as patients' pain is concerned, and in view of the fact that a single injection can save patients a good deal of discomfort, the present study was designed to review the GPC and HT approaches (3-7), to compare

Figure 1. Identification of the position of the major palatal foramen.

Figure 2. Infiltration of the mucosa above the major palatal foramen.

their characteristics and to consider recent studies reporting their inefficacy in anesthetizing the anterior maxillary oral cavity (1,8).

Materials and methods

Patients

Thirty adult patients attending the Dental Clinic of the University of Padua and scheduled for sinus elevation procedure were considered for inclusion in the study. The patients' physical and psychological status was evaluated prior to the appointment scheduled with the dentist, and their demographic data were recorded. The patients' level of dental fear was assessed using the Modified Dental Anxiety Scale (MDAS) and the Visual Analogue Scale for Anxiety (VAS-A) (9-12). The patients' clinical condition was defined using the "University of Southern California Medical history questionnaire" and their physical status was classified using the American Society of Anesthesiologists (ASA) scoring scale (13-15). Patients with cognitive/mental disturbances, anatomic defects of the jaw defined by radiographic examination (16), affected with oral infections, under treatment with anticoagulants, affected with coagulopathy or pregnant were excluded. The 30 patients enrolled in the study were randomly divided into two groups: 15 who underwent maxillary nerve block (MNB) via the Greater Palatine Canal (GPC) approach (GPC group) and 15 via the High Tuberosity (HT) approach (HT group). All of the patients agreed to participate in a telephone interview on the evening of the procedure, so that their impressions and reaction to the anesthetic effect could be registered within a short time of the experience. The study was granted approval by the local Ethics Committee (protocol n. 0069195; the date of approval December 12, 2016). All the patients were provided information about the modality and aims of the study and were asked to sign consent statements. The patients whose pre-surgical assessment confirmed high levels of anxiety (VAS-A≥5 cm and/or MDAS≥14) were orally administered 1 - 2 mg of chlordesmethyldiazepam (CDDZ) (EN®) 30 minutes before beginning the procedure; doses of diazepam were also administered intravenously using titration protocols (17-19). Patients' vital signs were monitored throughout the procedure using the SureSigns VM monitor. A topical local anesthetic cream (lidocaine and prilocaine) (EMLA®), was applied on the palatal mucosa above the greater palatine foramen in the GPC patients and on the vestibular mucosa corresponding to the zygomatic process at the second upper molar in the HT patients.

Maxillary Nerve Block via the Greater Palatine Canal approach (MNB-GPC) (4,5,20-25)

The patient is placed in a semi-supine position and instructed to open his/her mouth as widely as possible. The dentist identifies the greater palatine canal foramen by sliding a cotton swab back and forth between the alveolar maxillary process and the hard palate, from the area of the first molar, until the tip of the swab descends into the depression created by the greater palatine foramen located at the junction of the hard and soft palate. When the patient's teeth can be used as landmarks, the operator often finds it between the second and third molars, approximately 7 mm from the border of the hard palate or approximately 12 mm from the groove of the pterygoid process (26, 27). Using the end of the swab, the operator continues to apply pressure for one minute to produce a pressure anesthesia effect, leaving in this way an impression on the foramen. The mucosa is anesthetized by injecting 0.5 ml of mepivacaine containing epinephrine 1:100.000 (Figure 1). A self-aspirating syringe is attached to a 35 mm long 27G needle that is bent at 45° with respect to the syringe's axis (Figure 2) (28). When the tip of the needle penetrates the mucosa overlying the greater palatine foramen, the operator can

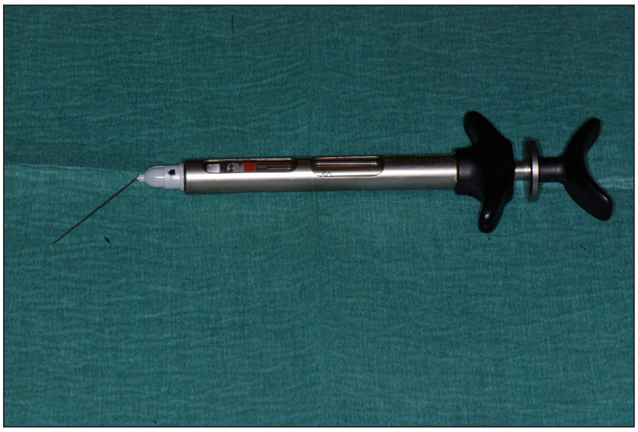

Figure 3. Self-suction syringe with needle 27 G long 35 mm folded at 45°.

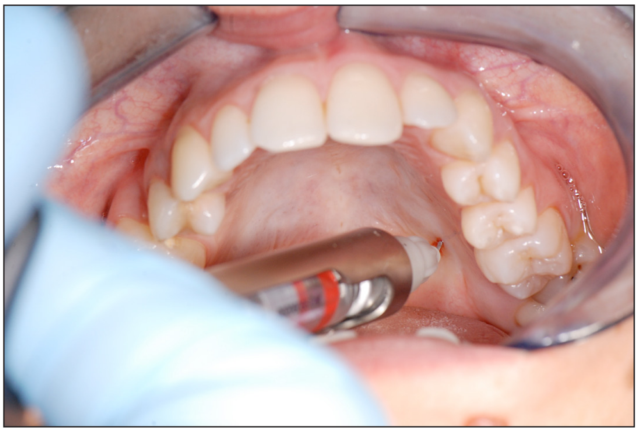

Figure 4. Penetration and advancement of the needle into the major palatine canal to a depth of about 35 mm.

Figure 5. Finger location of the zygomatic and maxillary tuber process, and also of the direction of penetration of the needle.

Figure 6. Penetration of the needle into the vestibular mucosa for a depth of 35 mm.

explore it by gently making the needle rotate until the tip penetrates the canal. The needle should penetrate the greater palatine canal superiorly and posteriorly to a depth of approximately 2.5-3.0 cm, without meeting any resistance (Figure 3). If any resistance is met, the needle should be retracted 1 mm, the angle should be slightly modified, and advanced once again. Once the desired depth has been reached and following aspiration, 1.8 ml of mepivacaine containing epinephrine 1:100.000 should be injected over a 60-90 second period; during this time the patient should be informed that he/she might feel a slight sensation of pressure in the lateral part of his/her face. Aspiration of blood suggests that the needle has penetrated into a vessel; aspiration of air suggests that it has penetrated the naso-pharyngeal passage.

Maxillary Nerve Block via the high tuberosity approach (MNB-HT) (4-8)

The patient should be placed in a semi-supine position and instructed to keep his/her mouth partially open. The technique is identical to the one described for the posterior superior alveolar block, except for the fact that the needle is longer and the target is deeper. The operator places his/her finger in the vestibular fornix and advances until the zygomatic process is reached (Figure 4). Right-handed operators rotates their finger (the index finger for a block to the left, the thumb for a block to the right) contemporaneously moving the cheek outwardly and positioning it in a plane at a 45° angle with respect to three planes: transversal, frontal, sagittal, that is, respectively in a cranial, dorsal, and medial direction. This maneuver visibly indicates the direction that the needle and the syringe should be placed (Figure 5). During the procedure the mandible must remain displaced to the same side of the injection site, so as to release the cheek and move the coronoid process into the vestibular space. The injection site can be found in the vestibular fornix at the second molar. Keeping the finger positioned on the zygomatic process, a 35 mm long 27G needle attached to a self-aspirating syringe is inserted (Figure 5). If the needle meets resistance, it means that the angle with respect to the sagittal plane is excessive. When the suitable depth is reached, the tip of the needle is in the pterygopalatine fossa, near the maxillary division of the trigeminal nerve. Following aspiration, 1.8 ml of mepivacaine containing Epinephrine 1:100.000 is injected over a 60 second period.

Evaluation of the block technique

The amount of time employed to carry out the procedures and the depths reached by the needle were calculated and registered. During the HT approach, the stem of the needle was always pushed to the end, reaching in all cases 3.5 cm (Figure 6).

At the end of each procedure, the dentist was asked to answer some questions. For the GPC procedure, he/she was asked if he/she had any difficulty in identifying the foramen, in penetrating it, in advancing the needle within the canal, if he/she had met any resistance while the local anesthetic was being injected and, finally, if he/she had noticed any positive aspirations. After the HT procedure, he/she was asked if he/she had had any difficulty in advancing the needle, if he/she had met any resistance when the local anesthetic was injected, if he/she had noted any positive aspirations.

Immediately after the procedure, the patients were asked if they had felt any pain during the injection or during/after the dental procedure itself or if there was any swelling of the cheek after the injection. They were asked to use the Visual Analogue Scale (VAS) (10 cm) to quantify their sensations.

Evaluation of anesthesia

From "0 time", corresponding to the end of the injection of the local anesthetic, the sensitivity of the dental pulp and of the vestibular-palatal soft tissues was evaluated every two minutes, using the pulp tester (Analytic Technology Pulp Tester®) and pinprick techniques, respectively (Figure 7). The anatomical areas that were chosen for evaluation were identified tracing an imaginary frontal plane tangent to the mesial surface of the first premolar. The first molar and the vestibular/palatal mucous membranes next to it in the posterior anatomical area were identified; if the tooth that was chosen was not vital, the one immediately next to it and its corresponding mucous membranes were chosen. The second incisive and the vestibular/palatal mucous membranes next to it in the anatomical area anterior to the imaginary frontal plane were identified. If that tooth was not vital, the one immediately next to it and the corresponding mucous membranes were chosen. The procedure begun when the patient had no sensitivity whatsoever of the pulp or the adjacent mucous membranes. Whenever the anesthesia failed, the dentist used an alternative anesthetic technique.

Figure 7. Pulp tester Analytic Technology.

Telephone interview

Each patient was interviewed by phone on the evening after the procedure. The questions concerned the efficacy of the pre and intraoperative anxiolytics, the pain caused by inserting the needle and penetrating the gingiva, the pain during/after the procedure and any unpleasant sensations. Pain was quantified using the VAS (10 cm).

Statistical analysis

The data are expressed as mean ±Standard Deviation (SD). The comparison between groups was carried out using Analysis of Variance and, when necessary, by $\chi 2$test with Yates correction. Sensitivity values measured by the pulp tester were evaluated using linear regression. A <0.05 p value was considered statistically significant.

Results

There was a significantly higher incidence of males in the GPC group ($\chi 2=7.3$; $p<0.01$), but there were no other statistical differences in the two study groups with regard to any other parameters

(Table 1). Additional infiltrations of local anesthetics were necessary in the vestibular area of the GPC group. They were also necessary in the area of both the greater palatine and the nasopalatine nerves in the HT group; the difference between the two groups was highly significant ($\chi2=8.3$; $p<0.01$) (Table 2).

We can infer from Figures 8 and 9 that in the area posterior to the frontal plane of the GPC group, there were highly significant correlations as a function of time in: anesthesia of the dental pulp and the premolar and molar teeth [p<0.0001 (a=33.3;bx=3.2; r=0.572)], anesthesia of the vestibular mucous membrane [p<0.0001 (a=25.8;bx=3.5; r=0.599)], anesthesia of the palatal mucous membrane [p<0.001 (a=46.6;bx=1.4; r=0.299)]. In the same area (posterior to the frontal plane) of the HT patients, there were highly significant correlations as a function of time in: anesthesia of the premolar and molar teeth and the vestibular mucous membrane [p<0.0001 (a=46.8; bx=1.9; r=0.569); anesthesia of the palatal mucous membrane was not correlated as a function of time (a=26.9;bx=1.0; r=0.201 ns).

We can infer from Figures 10 and 11 that in the area anterior to the frontal plane of the GPC group, there was a highly significant correlation as a function of time in [(p<0.0001; a=22.7;bx=2.3; r=0.376)]: the anesthetization of the incisors and canine teeth and of the vestibular and palatal mucous membranes [p<0.001 (a=30.2; bx=1.8; r=0.293)]. In the area anterior to the frontal plane of the HT group, there was a highly significant correlation as a function of time only for the anesthetization of the vestibular mucous membrane [p<0.0001 (a=31.3;bx=2.2; r=0.378)]. Correlations as a function of time were found neither for the anesthetization of the dental pulp of those teeth (a=25.1;bx=1.4; r=0.242 ns) nor for the anesthetization of the palatal mucous membrane (a=20.9;bx=0.9; r=0.215 ns).

Electrical stimulation (ES) values measured before and 10 minutes after the block was carried out in the two groups, are outlined in Table 3. A comparison of pre and post values showed that the values of the palatal mucous membrane in both the anterior and

Table 1 Characteristics of the patients enrolled in the study who were randomized into two groups: those undergoing the Greater Palatine Canal (GPC) and High Tuberosity (HT) approaches to maxillary nerve block

	GPC	HT
Patients (n)	15	15
Age (years)	36.8±18.7	30.0±11.2
Sex (M/F)	14/1	6/9**
Weight (kg)	73.7±7.4	67.3±9.8
MDAS (score)	10.8±2.9	12.3±5.8
VAS-A (cm)	3.5±2.2	4.8±2.2
ASA (1/2/3)	7/7/1	11/4/0

**p<0.01. Mean±Standard Deviation.
MDAS = Modified Dental Anxiety Scale;
VAS-A = Visual Analogue Scale for Anxiety;
ASA = American Society of Anesthesiologists

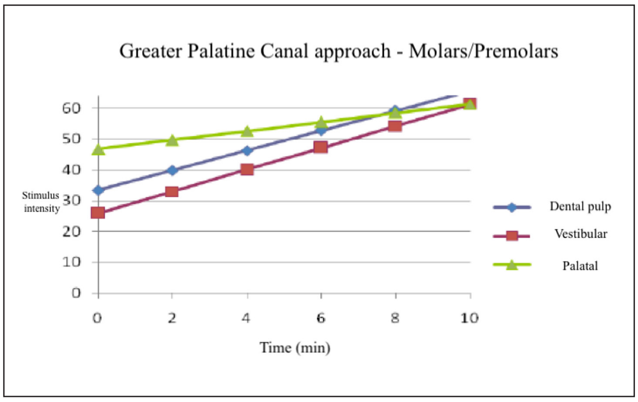

Figure 8 Dispersion plot of the linear regression of the stimulation data of the posterior area with Maxillary Nerve Block via the Greater Palatine Canal approach

Table 2 Characteristics of the dental procedure (duration) and of the anesthesia in the two groups (GPC and HT)

	GPC	HT
Duration of the procedure (min)	17.6±10.1	20.7±13.9
Pre-sedation with CDDZ (1/2 mg)	6/9	5/10
Diazepam dose titration IV (mg)	3.7±1.3	4.5±1.2
Needle penetration (mm)	27.1±3,8	35
Duration of the injection (min)	2.8±0.8	2.5±0.5
Additional injections (yes/no)	7/8	15/0**
Positive aspiration (yes/no)	0/15	0/15

**p<0.01. Mean±Standard Deviation; IV = intravenously

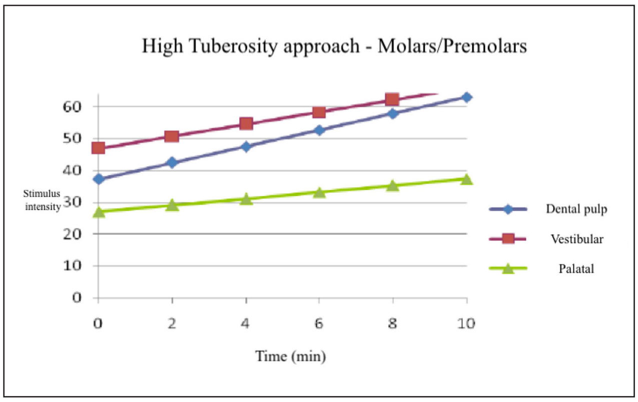

Figure 9 Dispersion plot of the linear regression of the stimulation data of the anterior area with Maxillary Nerve Block via the high tuberosity approach

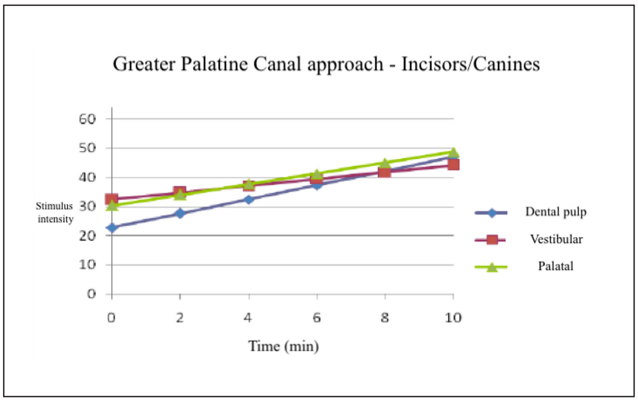

Figure 10 Dispersion plot of the linear regression of the stimulation data of the anterior area with Maxillary Nerve Block via the Greater Palatine Canal approach

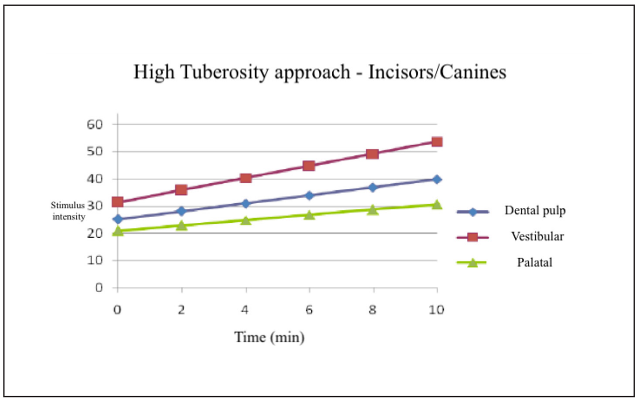

Figure 11 Dispersion plot of the linear regression of the stimulation data of the anterior area with Maxillary Nerve Block via the high tuberosity approach

posterior areas were significantly lower in the HT group with respect to the corresponding values in the GPC group [F=10.4 (p<0.01) and [F=22.5 (p<0.01)]. No significant differences were found in ES values between the two groups following stimulation of the vestibular mucous membrane and of the dental pulp in the anterior or posterior areas. A comparison of pre and post values showed that there were no significant differences in the HT patients with regard to the palatal mucous membrane in the anterior area (F=2.3; n.s).

When the operator was asked to comment on the experience immediately following the procedure, there were no differences in his/her opinion with regard to the difficulty encountered in executing the two techniques. When the patients were asked to comment on the experience immediately following the procedure, a significantly higher number in the GPC group reported pain when the needle was being inserted with respect to the number in the HT group (F=6.3; p<0.05) (Table 4).

When the patients were asked to comment on the experience during a telephone interview held later on that evening, there were no significant differences in the two groups with regard to the use of perioperative anxiolytics, considered satisfactory by all participants. A significantly higher number of patients in the GPC group reported pain while the needle was being inserted ($\chi 2$=5.7; p<0.05). There were no statistical differences between the two groups with regard to intra and post-operative pain or unpleasant sensations (Table 5).

Discussion

The present study aimed to investigate and compare the greater palatine canal and high tuberosity approaches to the maxillary nerve block in situations in which the area needing anesthesia corresponding to the pterygopalatine fossa was deep-seated. The patients in the two study groups, 15 individuals undergoing the greater palatine canal approach and 15 the high tuberosity (the GPC and HT) approach, received local anesthesia, following

Table 3 Sensitivity to electrical stimulation applied to the anatomical structures of the anterior and posterior parts of the jaw after maxillary nerve block in the two groups (GPC and HT). Measurements were taken at the end of the injection (control) and ten minutes later

	GPC		**HT**	
	(ES)		(ES)	
Posterior area	Control	After 10 min	Control	After10 min
Dental pulp	24.3±11.5	64	20.6±4.8	59.5±11.5
Vestibular mucosa	23.5±13.8	58.7±12.5	33.6±18.6	64
Palatal mucosa	26.6±17.1	59.4±10.8	24.4±12.3	36.3±14.6**
Anterior area	Control	After 10 min	Control	After 10 min
Dental pulp	18.3±8.0	47.0±16.2	22.0±16.1	37.9±13.3
Vestibular mucosa	20.6±10,2	42.0±18,7	34.5±17.2	53.1±11.4
Palatal mucosa	21.8±11.8	48.6±17.0	22.4±13.3	30.0±13.0**

(ES = Electrical stimulation). Mean±Standard Deviation.
**p<0.001.

Table 4 Questions asked to dental surgeons and patients (15 belonging of the GPC group and 15 of the HT group) immediately following the procedurer

Questions asked to the dental surgeon	**GPC**	**HT**
Was the foramen identified? (yes/no)	6/9	NA
Was the foramen penetrated? (yes/no) NA	3/12	NA
Was the needle advanced? (yes/no)	3/12	0/15
Did the needle encounter any resistance? (yes/no)	0/15	0/15
Questions asked to the patient		
Did you have any pain while the anesthetic was being injected? (yes/no)	11/4	6/9
How intense was the pain? (VAS-P: cm)	4.2±2.9	2.0±2.7*
Did you feel any swelling? (yes/no)	4/11	0/15
Did you have any intraoperative pain? (yes/no)	2/13	3/12
How intense was the intraoperative pain? (VAS-P: cm)	0.9±2.0	1.1±2.3

* p<0.05. Mean±Standard Deviation. NA: Not applicable; VAS-P = Visual Analogue Scale for Pain.

the techniques described above (18-20) in order to maximize their comfort during the procedure and to reduce their physiological response to stress (29). Despite these precautions, the patients in the GPC group experienced more intense pain that could be attributed to either/both the greater sensitivity of the palatal mucosa with respect to the vestibular one and/or using a needle in the greater palatine canal. As no data can be found in the literature describing the intensity or incidence of pain in association with these techniques, it can be hypothesized that the pain experienced by the patients was linked to the dentist's lack of experience in carrying out the block and to an inadequate knowledge of the region's anatomy leading to difficulty in identifying the angle of the palatine canal which can vary between 20 and 70 degrees (25, 30) .

The equipment used during the current study was a self-aspirating syringe, a vial containing 1.8 ml of mepivacaine 2% and epinephrine 1:100.000, and 35 mm long 27 G needles. As other investigators have utilized local anesthetics containing various quantities of epinephrine (between 2.2 and 4.4 ml) and needles whose diameters and lengths ranged between 25 - 27G and 30 – 41 mm, respectively (8,20-25), it is possible that those features were the cause of the numerous complications that have been described for nerve block (4, 5, 31, 32). A common complication associated with maxillary nerve block is transient diplopia, which is caused by excessive needle penetration causing diffusion of the local anesthetic in the inferior orbital fissure. Diplopia occurs when needles are longer than 39 mm and the volume of local anesthetic is superior to 2.2 ml (23). Despite the fact that an 89% success rate was achieved when Sved et al. (31) used approximately 4.4 ml of local anesthetics, those investigators reported some complications such as palpebral ptosis in 9.9% of cases and strabismus in 11.8%.

Limiting the volume of anesthetic and the length of the needle, as proposed by Wong and Sved (23), did not seem to be effective in preventing these complications when the block via the high tuberosity

Table 5 Questions posed to the patients of the two groups (GPC and HT) during the telephone interview held the evening of the procedure

	GPC	**HT**
Patients (n)	15	15
Did you receive any preoperative anxiolytic medication? (yes/no)	14/1	15/0
Did you receive any intraoperative anxiolytic medication? (yes/no)	15/0	15/0
Did you have any pain when the needle was inserted into the gum? (yes/no)	1/14	0/15
Did you have any pain while the needle was being pushed into the gum? (yes/no)	8/7	1/14*
Did you have any pain during the dental procedure? (yes/no)	4/11	3/12
Did you have any postoperative pain? (yes/no)	2/13	1/14
Did you have any unpleasant sensations? (yes/no)	0/15	1/14

* p<0.05.

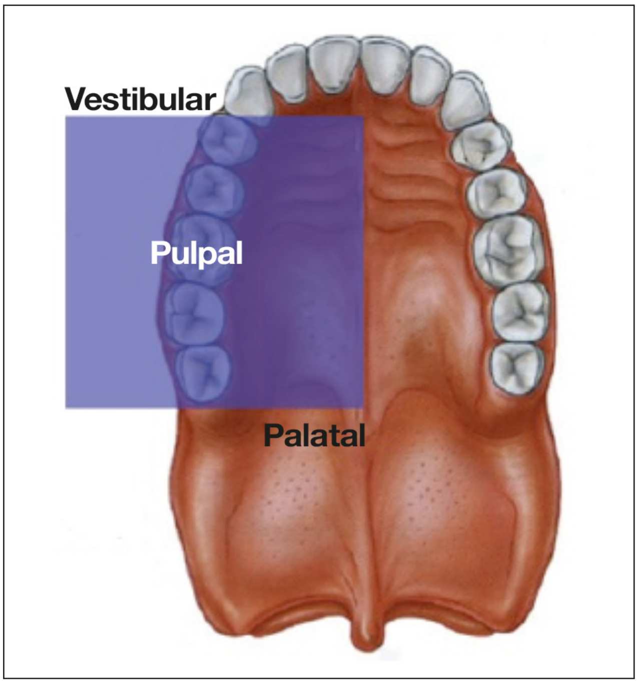

Figure 12 Dispersion plot of the linear regression of the stimulation data of the posterior area with Maxillary Nerve Block via the Greater Palatine Canal approach

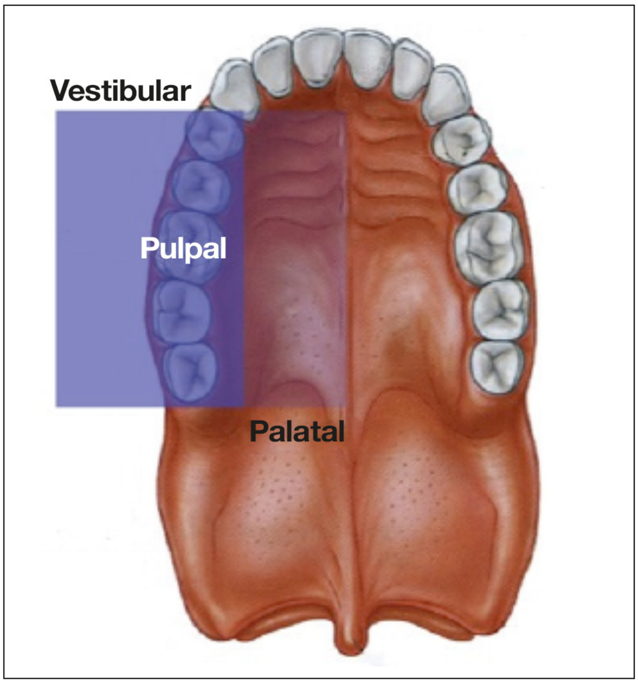

Figure 13 Maxillary nerve block via the high tuberosity, extension of posterior anesthesia area Vestibular

approach was used. When this technique is used, in fact, the depth of the needle and the volume of the local anesthetic that are needed to obtain nerve block without incurring the risk of eye complications are superior to those recommended for the greater palatine canal and correspond to a 3.5-4.5 cm needle penetration depth and 2 ml of local anesthetic (21). Our study showed that a fixed volume of local anesthetic (1.8 ml) and a mean needle depth of 27 mm and 35 mm, respectively, for GPC and HT approaches, are not linked to any complications and that the nerve block techniques used here can prevent some complications described by several authors in the posterior part of the jaw.

Our study also showed, however, that the two techniques differed as far as the efficacy of the anesthetic effect was concerned. Study findings demonstrated that the GPC approach made it possible to obtain a significantly greater anesthetic effect as a function of time for both the dental pulp and the palatal and vestibular mucous membranes in the posterior part of the jaw. In fact, the maximum anesthetic effect of the dental pulp was reached in 100% of the patients within 10 minutes of injecting the local anesthetic (Figure 12). When the HT approach was used, the anesthetic effect in the posterior part of the jaw ten minutes after the injection was similar to that obtained via the GPT approach but unequal to that in the other anatomical areas explored: in the dental pulp it was reached in 86.6% of the patients; in the palatal mucous membrane it was practically inexistent; in the vestibular mucous membrane the maximum anesthetic effect was found in 100% of the patients. These results indicate that even when the same dose of local anesthetic was used, the HT approach did not reach a mean concentration that was adequately effective in blocking conduction of the fibers of the pterygopalatine fossa (Figure 13).

The analgesic effect as a function of time in the tissues of the anterior part of the jaw was found to be inferior with respect to that observed in the tissues of the posterior part of the jaw for both techniques. The efficacy of analgesia in the anterior part of the jaw was significantly inferior for the HT approach in particular at the palatal mucosa membrane, where the maximum anesthetic effect was obtained in only 6.6% of patients. Whereas, when the GPC approach was used, the maximum anesthetic effect was obtained in 46.6% of patients. Similar values were noted after stimulation of the vestibular mucosa (in 33.3% of the GPC patients; in 46.6% of the HT patients) and of the dental pulp of the anterior part of the jaw (in 40% of the GPC patients; in 13.3% of the HT patients). The marked differences in the anesthetic effect in the anterior part of the jaw indicate that after coming into contact with the sensitive branches of the pterygopalatine and the infraorbital nerve the local anesthetic is unable to reach the fibers localized in the central part of the nerve which are blocked belatedly and erratically. Study results showed that the HT approach does not seem to engage the sensitive fibers of the pterygopalatine branches which seem to be excluded from the effect of the local anesthetics. The anesthesia of the palate and the dental pulp of the anterior part of the jaw was ensured by troncular infiltration of the greater palatine and nasopalatine nerves or by supraperiosteal infiltrations.

Our study confirmed that the maxillary nerve block is achieved more effectively by means of the GPC approach, as the tip of the needle reaches the superior extremity of the pterygopalatine fossa. The mandibular nerve generates sensitive terminal branches in that anatomical area before it enters into the inferior orbital fissure called the infraorbital groove. A quantity of a local anaesthetic and needle depths similar to those used in our study and described by other authors (22) lead to a higher incidence of complete maxillary nerve block. We found that it was difficult to obtain a block that was sensitive to the pterygopalatine component of the jaw nerve when the HT approach was used. After exiting the jaw nerve, these fibers cross the sphenopalatine ganglion moving lateral to it. It is important to remember that although the sphenopalatine ganglion is found in the pterygopalatine fossa, it occupies the inferior part corresponding to the superior foramen of the greater palatine canal. The ganglion is thus situated in an excellent place to be reached by a local anesthetic via GPC, but in an unfavorable one for receiving it via HT. The tip of the needle for this approach should be introduced into the pterygopalatine fossa through the lateral pterygopalatine fissure to anesthesize the pterygopalatine part of the jaw nerve. We are of the opinion that the anatomic characteristics of the area, the relatively low amount of local anesthetic used, and the limited needle penetration depth all contributed to making the technique less apt for deep sedation of the palate.

Conclusion

Only a few studies have focused on the efficacy of the block of the second division of the trigeminal nerve, and the results of the present one are compatible with what has already been described regarding the greater palatine canal and high tuberosity approaches used to obtain maxillary nerve block. Although the maxillary nerve block is generally considered a relatively safe and effective procedure, it is not particularly popular among dental practitioners. The same can be said for the posterior superior alveolar nerve block whose utilization could facilitate employment of the maxillary nerve block given the resemblance between the two techniques. There seems to be uncertainty as far as skill in execution and knowledge about anatomy and complications associated to it. We would like to conclude specifying that the pharmacological and non-pharmacological anxiolytic techniques and the anesthetic infiltrations used to compensate for the inadequate anesthesia utilized in the patients of the present study did, in any case, ensure a low incidence of intra and postoperative pain, no noteworthy complications and patient satisfaction (33).

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