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Original Research

Mapping the extent of Greater Palatine Nerve Block: A Clinical Study

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ABSTRACT:
Background: Greater Palatine nerve block is indicated when the palatal soft tissue anaesthesia is required, but because of the variations in the area of numbness after administration of greater palatine nerve blocks, this study aimed to investigate and map the complete extent of anesthesia achieved with this block. **Materials and methods**: 100 North Indian patients(53 males and 47 females)requiring maxillary posterior surgical intervention whoreported to the department of Oral and Maxillofacial Surgery at our Institute were randomly selected. 0.5 ml solution of 2% lignocaine with 1:200,000 adrenaline was injected between 2nd and 3rd maxillary molars. The pattern of each patient's anaesthetized area was noted down on the mapping record chart. Informed consent for the procedure was obtained from all the patients enrolled for the study after taking clearance from institutional ethical committee. **Results**: No difference in the distribution of area anesthetized was found between genders. Highest percentage of completely anesthetized area were extending upto the second premolar in 42% cases, upto the first premolar in 38% cases, upto the first molar in 14% cases and more detriment upto the canine which was seen only in 6% of the cases. Pearson's Chi square was used to test the differences in area of extent of anaesthesia. **Conclusion**: The present study provides valuable information regarding the anatomy and its variations to be considered during greater palatine nerve block, which will benefit the clinicians who have to administer multiple injections during various procedures leading to more comfortable experience for the patient.
Keywords: Greater Palatine Nerve Block, area anesthetized, maxillary molars, maxillary premolars

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INTRODUCTION

One of the most commonly used anaesthetic blocks is greater palatine nerve block. Two techniques in literature have been described for greater palatine block (high tuberosity/ greater palatine canal approach). It is useful for anaesthetising the palatal soft tissues distal to the canine.[1] It is highly effective method of achieving profound analgesia of the hard and soft tissues of the hemi-maxilla with one injection. It is less traumatic than the nasopalatine nerve block because the palatal tissue in the area of the injection site is not as anchored to the underlying bone as in the anterior palate. A greater Palatine nerve block is indicated when the palatal soft tissue anaesthesia is necessary for minor oral surgical procedures, restorative treatment on more than two teeth (insertion of subgingival matrix bands) and periodontal procedures.

The greater palatine nerve (anterior palatine nerve) [GPN] is a branch of the pterygopalatine ganglion that carries both general sensory fibres from the maxillary nerve and parasympathetic fibres from the nerve of the pterygoid canal. It descends through the greater palatine canal, emerges upon the hard palate through the greater palatine foramen, and passes forward in a group in the hard palate, nearly as far as the incisor teeth. It supplies the gums, the mucous membrane and glands of the hard palate, and communicates in front with the terminal filaments of the nasopalatine nerve.[2, 3]

Locating the greater palatine foramen is important clinically when posterior palatal anaesthesia is desired. Westmoreland and Blanton in their study found the distance of Greater palatine foramen as 0.19 cm from posterior border of the hard palate and 1.5 cm from palatal midline. Authors found that the foramen opens in a more inferior (vertical) direction in majority (82%) of the dry East Indian ethnic skulls.[4] In contrast Sharma N et al in Indian population reported the direction of opening of greater palatine canal on to the hard palate as anteromedial in 60.10% cases, anterior in 31.81% cases followed by anterolateral direction in 8.09% cases.[5]

Anaesthesia of the hard palate is necessary for a variety of maxillofacial and dental procedures involving the manipulation of palatal hard and soft tissues. The hard palate is supplied by two main sensory nerves the greater Palatine and nasopalatine. The boundary between the areas innervated by the nasopalatine and greater palatine nerves corresponds roughly to a line drawn between the maxillary canines, however the two areas are not so sharply delineated. In our experience there is considerable overlap between the areas anaesthetized by greater palatine and nasopalatine blocks particularly in the first premolar region. Because of the variations in the area of numbness after administration of greater palatine nerve blocks, this study aimed to investigate and map the complete extent of anesthesiaachieved with greater palatine nerve block.

MATERIAL AND METHODS

100 North Indian patients (53 males and 47 females) above 18 years of age without any systemic disease requiring maxillary posterior surgical intervention were randomly selected who reported to the department of Oral and Maxillofacial Surgery at our Institute for routine out-patient work. The patients were aged between 21-70 years with the average age of 30 years. Patients requiring extraction of maxillary anterior teeth only or mandibular teeth and patients with neurological diseases, psychiatric problems, history of drug allergy, moderate to severe uncontrolled systemic conditions which required close observation and follow-up were excluded from the study. The procedures performed in these patients after the administration of greater palatine nerve block were simple extractions, third molar extractions and other minor oral surgical procedures (Table 1).

Table 1: Surgical interventions in 100 patients

Types of procedures	Number of patients
Minor oral surgical procedures	04
Third Molar Extractions	06
Simple Extractions	90

All examinations and treatment were performed with the signed consent of the patients in the presence of a witness. Informed consent for the procedure was obtained from all the patients enrolled for the study after taking clearance from institutional ethical committee.

The greater palatine nerve block was given and evaluated by the same surgeon. The greater palatine foramen was approached from the opposite side using 1 inch 25 gauge needle kept as near to a right angle as possible with the curvature of palatine bone.[6]

0.5 ml solution of 2% lignocaine with 1:200,000 adrenaline (LOX 2%, NEON laboratories limited, India) was injected between 2nd and 3rd maxillary molars about 1cm from the palatal gingival margin towards the midline. 2 minutes after the injection, anaesthesia was detected at each point with a sharp probe (calibrated by instrument weight about 20 – 40 gms). The completely anaesthetized points were investigated at the horizontal level from tuberosity region to the mesial of canine tooth and at the vertical level from the palatal interdental papilla to the midpalatine raphe region. The pattern of each patient's anaesthetized area was noted down on the mapping record chart. After the anaesthetized points were detected, the posterior superior alveolar (PSA) nerve block and infraorbital nerve blocks whichever required were undertaken to continue the surgical procedures. The data obtained was subjected to statistical analysis.

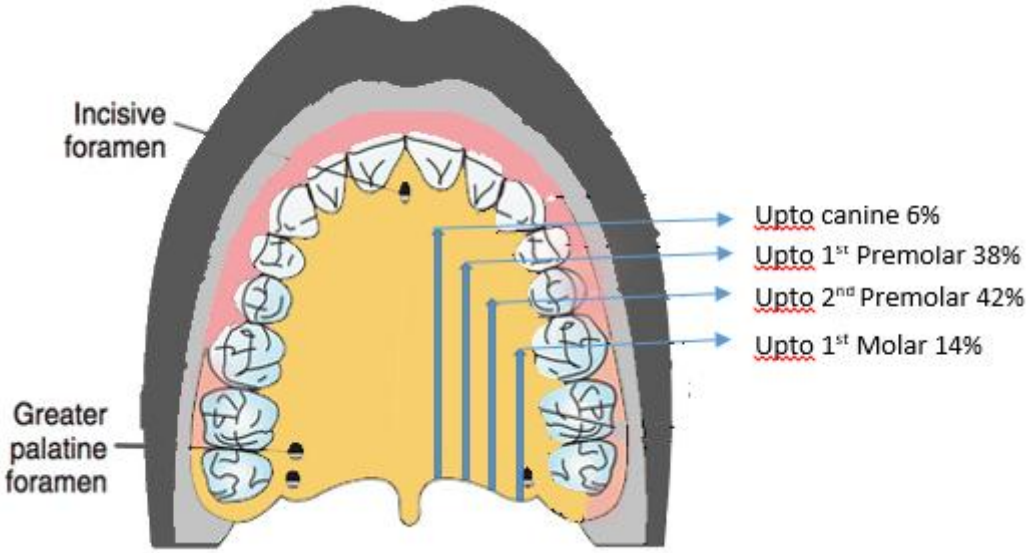
RESULTS

Table 2 (fig 1.) shows the percentages of anaesthetised extent from tuberosity region anteriorly. No difference in the distribution of area anesthetized was found between genders. Highest percentage of completely anesthetized area were extending upto the second premolar in 42% cases, upto the first premolar in 38% cases, upto the first molar in 14% cases and more detriment upto the canine which was seen only in 6% of the cases.

Table 2: Percentages of patients per areas anaesthetized with greater palatine nerve block (n=100)

Anterior most point of effectiveness of anaesthesia in maxilla	Percentage of patients (%)
Upto first molar	14
Upto second premolar	42
Upto first premolar	38
Upto canine	06

FIG1: Anterior most point of effectiveness of anesthesia in maxilla



Pearson's Chi square was used to test the differences in area of extent of anaesthesia. A high value of (χ^2)showed highly significant results ($p<0.001$). The area of extent was further analyzed by comparing the portion of area of extent upto first molar with second premolar and first premolar. It was found that proportions of the patients with anesthesia effect upto second premolar was significantly higher than upto first molar ($p< 0.0022$). Similarly the first premolar had significantly higher percentages of anaesthesia effectiveness as compared to the first molar ($p<0.00061$). The difference between the effectiveness of anaesthesia between the two premolars was not statistically significant ($p<0.6506$).

DISCUSSION

Thorough knowledge of the anatomy i.e course and branching pattern of greater palatine nerve is extremely important to dental as well as oral and maxillofacial surgeons. GPN exits the pterygopalatine ganglion inferiorly and travels anterior-inferior in the greater palatine canal (pterygopalatine canal) along with the greater palatine artery and, occasionally, the lesser palatine nerves until they exit through the greater palatine foramen. After exiting through the greater palatine foramen, the nerve divides into several branches that travel anteriorly within the mucosal tissue lying medial to the maxillary premolars, divides into 2 or 3 major branches which further divides into smaller branches that finally intermingle with the branches of the nasopalatine nerves within the mucosa, innervating the secondary portion of the hard palate, its mucous membranes, blood vessels, minor salivary glands, and the inner aspect of the superior alveolus.[2, 7, 3]

Greater palatine nerve block is often used in minor oral surgical procedures, periodontics and general dentistry.Greater palatine nerve block along with the nasopalatine nerve block are considered to be effective for the complete anesthesia of the palate. The patients perception to pain is twice in nasopalatine nerve block when compared to GPN block and is also considered to be more technique sensitive.[9] An extensive study done by Pashley et al, (1981) showed the highest maximum injection pressure in incisive papilla (18,224 mmHg) in comparision to hard palate (11,322 mmHg).[10]

The mucosa covering the area of the greater palatine foramen is also a donor site for soft tissue grafts. In the study given by Fu JH et al the location of greater palatine neurovascular bundle in relation to the height of the palatal vault, was found to be on an average of 7, 12 and 17mm from the cement-enamel junctions of the premolars and molars in shallow, average, and high palatal vaults, respectively which assists the clinicians in planning connective tissue graft procedures on the hard palate.[8]The position of injection for greater palatine nerve block was between 2nd and 3rdmaxillary molar in the present study. Variations in the location of the GP foramen have been reported in the literature.[2]Matsuda was the first to describe the location of greater palatine foramen. [11]Fu JH et al (2011) [8] did a cadaveric study and also reported the most frequent location of greater palatine foramen between 2nd and 3rd molars (66.6%). Wang et al (1988) [25]in their study on adult Chinese skull also reported the location of greater palatine foramen between 2nd and 3rd molar in 48% cases followed by palatal to 3rd molar in 33.5% cases.In contrast the study on Brazilian patients by Ikuta et al (2013), [12]reported that GPF were located medial to the third molar in 3/100 patients and distal to the third molar in 5/100 patients. However in 92/100 cases GPF was focused to be located on the palatal sideof third molar.

No GPF were found medial to the second molar in the study.[12,13]However the study by Saralaya V et al, (2007)[14] reported that 74.6% of GPF was positioned opposite to the third molar, 24.2% between the second and third molar, 0.4% opposite to the second molar and 0.8% distal to the third molar which is in accordance with the study given by Sharma et al, (2021) [5]wherein most common location of GPF was found to be in line with third molar tooth with an incidence of 71.21% followed by position between second and third molar tooth in 49% of skulls. However the presence of GPF behind the third molar tooth in 8% skulls was the rarest location and no foramen was found opposite to 2nd molar tooth.[5,14,15,16]In study given by Lipere A and Das S reported that GPF is most often located distal to maxillary second molar and its average length being 32mm. [18,19, 20] whereas in the study given by Narayan et al (2020) GPF was located medial to the third molar in 68.5% of cases, behind the third molar in 8.5% cases and behind the second molar in 22.8% of cases. [17]

The study given by Hafeez et al (2015), stated that in 8 out of 20 dissection specimens (40%) the GPN did not emerge from the greater palatine foramen as a single trunk but exited the foramen in the form of thick medial and slender lateral nerve trunk. These anatomical variations in position and branching of GPN has important implications for effectiveness of anesthesia.[2]

In the present study, out of 100 patients,53 males and 47 females ranging in age from 21-70 years participated in the study. No difference in the distribution of area anesthetised was found between the genders. Ikuta CRS et al (2013) in their anatomic study through CBCT on position of greater palatine foramen also found no difference in greater palatine foramen location between genders and sides. Authors observed greater palatine foramen location more closely related to the third molar and thus stated that erupted third molar could be used as landmark for successful greater palatine nerve block anesthesia.[12]

The results of the present study showed that, the greater palatine nerve block successfully anesthetised the palate upto second premolar in 42% patients, upto first premolar in 38% of patients. In 14% patients till the first molar followed by 6 %patients upto canine.(Fig 1) In contrast, the study given by Sundar GTP et al(2020), reported that in 36% patients out of 100, the anesthetic effect of greater palatine nerve block extended upto the distal papilla of central incisor, till the lateral incisors in 28% of patients and till canine in 20% of patients. In only 16% of cases the greater palatine block couldn't anesthetise the anterior palate required for anterior tooth removal. The authors further commented that the anesthetic effect did not reach till the interdental papilla between two central incisors in any of the patient which might be because of the contralateral nerve supply from the opposite side.[9]

Broering et al (2009), in their study on comparision of anesthetic efficacy of the greater palatine and high tuberosity second division nerve blocks also reported that 100% (40/40) anesthetic success was observed upto 2nd molar via the GPN block followed by 95% success upto first molar, 80% upto second premolar, 68% upto first premolar, 60% upto canine and 43% and 23% upto lateral and central incisors respectively.However both the techniques were ineffective for profound pulpal anesthesia of anterior teeth and first premolar.[1]

There were no complications reported in the present study. However Malamed also reported occasional side effects with second division nerve block.[21] In the study given by Broering et al, diplopia was the most common complication reported (18%), followed by paresthesia (12%), mandibular lip numbness (12%), mydriasis (10%), non-negotiable canals (8%), and blurred vision (2%). Sved AM et al also reported 36% incidence of diplopia when using 2.2-8.8 ml of 2% lidocaine with 1: 100000 epinephrine for 2nd division nerve blocks via greater palatine canals.[22, 7]

In accordance with above study Aoun et al also reported diplopia as the most common complication (35.6%), resulting from the accidental block of the abducens nerve (the 6th cranial nerve) innervating the lateral rectus muscle, one of the extraocular muscles, by dissemination of the anesthetic through the superior orbital fissure. [20, 23, 24]

In conclusion, the present study provides valuable information regarding the anatomy and its variations to be considered during greater palatine nerve block. However the sample size was small and renders potential for further studies with bigger sample size.The results of the present study also provides an update regarding the extent of action of anesthesia by the greater palatine nerve block which will benefit the clinicians who have to administer multiple injections during various procedures leading to more comfortable experience for the patient. An attempt has been made to present a detailed description of the complexities and variability of innervation of greater palatine nerve. A thorough understanding of these neuroanatomical concepts is necessary to induce profound dental local anaesthesia on a more consistent basis.

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