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Efficacy of Extra-Oral Maxillary Nerve Block Technique Using Frontozygomatic Approach

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Abstract- Pain control is an integral part of minor oral surgery and maxillary/mandibular nerve blocks have proved promising in achieving the same. Although intra-oral techniques of maxillary nerve block are common and are widely used, there are certain inherent disadvantages and potential complications. Less commonly described in the literature, the extra oral techniques have a wide spectrum of indications as well as can be more advantageous than the intra oral approach [3]. Hence the aim of present study is to evaluate the feasibility and the efficacy of the extra-oral maxillary nerve block using Frontozygomatic approach.

Keywords- Frontozygomatic Angle, Extra oral maxillary nerve block, Pterygopalatine fossa.

I. INTRODUCTION

Use of intra-oral techniques of maxillary nerve bock are common and are widely used, although there are certain inherent disadvantages and potential complications such as multiple needle pricks for multiple extractions in single quadrant particularly in the maxilla . There are various techniques outlined for rendering anesthesia of the maxillary nerve through extraoral approach and could be classified as suprazygomatic and infrazygomatic techniques. [5]

The most popular approach has been via the sigmoid notch: a variant of the infrazygomatic approaches. The extra-oral techniques have a wide spectrum of indications as well as can be more advantageous than the intra-oral approach.

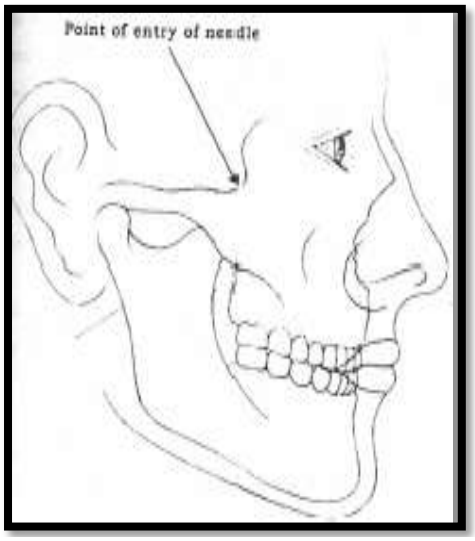
Indications of extra-oral nerve block include, the need to anesthetise the entire distribution of the maxillary nerve for extensive surgery where general anesthesia is not possible, presence of local infection, trismus, and other conditions which makes blocks of the more terminal branches of maxillary nerve difficult or impossible.

Suprazygomatic approach from frontozygomatic angle has been recommended amongst the safest approach as compared to infra-zygomatic approach. This approach involves injection of solution in the vicinity to the foramen rotundum with the only complication being damage to the blood vessels of infratemporal fossa particularly the maxillary artery and venous plexus [5] .

Hence the main aim of the clinical trial is to determine the pain analysis of extra-oral and intra-oral approach for maxillary nerve block technique in patients undergoing extraction of maxillary teeth.

- 30 Patients of age groups between 18 to 70 years were selected from the department of oral and maxillofacial surgery, V.S dental college, Bangalore, Karnataka fulfilling the inclusion criteria.
- The study design was discussed with every selected patient and his / her written consent was taken prior to commencement of the study.
- Patient age 18-70 years receiving extra-oral maxillary nerve block through Frontozygomatic angle approach.
- A 21 gauge spinal needle with 5ml disposable syringe was used. 3ml of 2% lignocaine with 1:80,000 epinephrine was used for a single block.

- The needle entry point being the skin projection of frontozygomatic angle which is the angle formed by the superior edge of the zygomatic arch below and the posterior orbital rim forward to the skin advancing to reach the greater wing of sphenoid bone 0.5ml of local anaesthesia was administered.



II. MATERIALS AND METHOD

The study was conducted on 30 patients reporting to the Department of Oral and Maxillofacial Surgery, V. S. Dental College and Hospital, Bangalore, Karnataka from September 2015 to July 2016 taking into consideration the exclusion and inclusion criteria extraoral maxillary nerve block using frontozygomatic approach was administered.Intraoperative and postoperative complications which may include hematoma, ecchymosis, visual disturbance, limitation of mouth opening or deviation of the lower jaw and Brain Stem Anesthesia immediately following the injections. The data collected was analyzed statistically by using descriptive statistics and percentage; co-relations were computed using the student Chi Square test for proportions.

ANATOMICAL MARKING

- The injection needle was inserted until contact with the greater wings of sphenoid is made with the bone.
- After confirming the needle was in contact with the greater wings of sphenoid it was advanced to the infratemporal fossa angulated approximately at 60^0 and 10^0 to sagittal and horizontal planes respectively.
- To avoid pain 0.2-0.3 ml of local anaesthesia was injected each time before advancing the needle to about 5-8mm.
- When the rubber marker approaches the surface of the skin, patients was instructed to warn the surgeon when they felt local anaesthetic dropping in their nose or throat.

STOPPER MARKING KEPT BETWEEN 50-80MM; WHEN TOUCHES THE SKIN

- This meant that the tip of the needle had reached the posterior wall of the pterygopalatine fossa and penetrated the nasal mucosa.
- The needle was then be withdrawn for 3–5 mm to avoid intranasal injection and after careful aspiration in at least in 2 different planes about 30^0–40^0 apart, the remaining drug was then slowly deposited into the vicinity of the foramen rotundum

RESULTS

Successful anesthesia was secured in first attempt in 27 patients while in 1 patient, the procedure had to be repeated using local infiltration due to positive aspiration using the Fronto-zygomatic approach owing to the difficulty in reaching the target site.In 2 patients the stopper over the spinal needle reached the sphenoid bone at 30mm which is 20mm short of the actual penetration of the needle and the reason suspected to be the anatomical variations. A majority of the patients i.e., 53.3 % scored 0–2 (no pain) on visual analogue scale (VAS) while 11 patients experienced mild pain and only 3 patients experienced moderate degree of pain. Subjective symptoms were reported in 22.73 s (mean value) and 18.3 s (mean value) in the palate and the infraorbital fossa respectively. Peak effect of anesthesia was noted in 62.8, 39 and 31.71 sec (all values expressed as mean) in palate, infraorbital fossa and posterior superior alveolar areas respectively.

Demographically, sample of 30 patients were selected randomly out of which
13 patients were males while 17 patients were females. 30 patients, extraoral maxillary nerve block was administered using Fronto-zygomatic approach.
In all, a successful local anesthesia was secured in 27 patients in first attempt while in 3 patients failure to secure anesthesia was noted out of which 1 case of positive aspiration was noted while administering the extraoral maxillary nerve block suspecting the needle could have been in the pterygoid plexus.

Positive Aspiration While Administration of Local Anaesthesia

All the 3 cases of failure to secure anesthesia using extraoral maxillary nerve block using Fronto-zygomatic approach were administered local infiltration. In two patients, the needle reached 30mm while in rest 28 patient's rubber stopper touched the skin at 50 mm while the anesthesia was secured.The study parameters included were pain during the administration of local anesthesia evaluated as per visual analogue scale, onset of anesthesia in accordance with the subjective feeling of the same in seconds, objective evaluation of symptoms termed as peak effect, pain during extraction as per VAS and duration of anesthesia assessed in hours. All the parameters were statistically evaluated and a mean value along with standard deviation was obtained.As seen in Table 1, 16 patients did not experience pain during the administration of the anesthetic [VAS score 0–2 (no pain)]. 11 patients scored 4 (mild pain) and 3 patients experienced a moderate pain (score 7). None of the patients complained of severe pain. The mean pain score was calculated as 2.7.and standard deviation of 1.4

Table I

Description of the pain perception during Injection among the study participants			
Procedure	**Pain**	**n**	**%**
Pain During Injection	No Pain	16	53.3%
	Mild Pain	11	36.7%
	Mod. Pain	3	10.0%
	Severe Pain	0	0.0%
		Mean	SD
	Mean & SD	2.7	1.4
	Range	1 - 6	

After the local anesthesia was secured, the dental extraction was carried out in accordance with the standard procedure by a single operator in all the patients, and the operative pain was evaluated according to VAS. 19 patients scored 1 (no pain), 7 patients scored 3–5 (mild pain) while no patients scored 6 (moderate pain) and severe pain. A mean value was calculated and was 1.9 with a standard deviation of 0.9 (Table 2).

Table II

Description of the pain perception during Extraction among the study participants			
Procedure	**Pain**	**n**	**%**
Pain During Extraction	No Pain	19	73.1%
	Mild Pain	7	26.9%
	Mod. Pain	0	0.0%
	Severe Pain	0	0.0%
		Mean	SD
	Mean & SD	1.9	0.9
	Range	0 – 3	

Onset of anesthesia evaluated in seconds varied according to the anatomic site. In the palate, in 11 patients the onset of anesthesia was noted <20 seconds, in 7 patients it was noted within 21-30 s, in 4 patients it was within 31-40 s, while in 4 patients, the time duration was within 31-35 s as depicted in Table 3.Calculated mean value was 22.73 and the standard deviation was 7.3.In infraorbital fossa, 23 patients reported subjective symptoms in less than < 20seconds, 4 patients within 51 seconds, with an overall mean value of 18.3 seconds with a standard deviation of 14 seconds Table 3.

Table III (A)

Description of the Onset of Anaesthesia in Palate Area among the study participants

Anaesthesia	Time	n	%
Onset of Anaesthesia in Palate	<20sec	12	40.00%
	21-25sec	7	23.33%
	26-30sec	4	13.33%
	31-35sec	4	13.33%
	Mean & SD	22.73	7.3

Description of the Onset of Anaesthesia in Infra Orbital Area among the study participants

Anaesthesia	Time	n	%
Onset of Anaesthesia in Infraorbital Area	< 20 secs	23	85.20%
	51 secs	4	14.80%
		Mean	SD
	Mean & SD	18.3	14.0
	Range	9 – 51	

The peak effect of anesthesia has been denoted in Table 4 and the time duration varied according to the anatomical site. In palate 16 patients needed 55–65 s. In 8 patients objective symptoms were noted within 66–75 s.

Description of the Peak effect obtained time among the study participant

Anaesthesia	Time	n	%
Peak Effect in PSA Region	21-30 secs	16	59.3%
	31-40 secs	7	25.9%
	41-45 secs	4	14.8%
		Mean	SD
	Mean & SD	31.7	7.3
	Range	24 – 45	
Peak Effect in Palate Region	55 - 65 sec	16	59.3%
	66 - 75 sec	8	29.6%
	76 - 90 sec	3	11.1%
		Mean	SD
	Mean & SD	62.8	9.6
	Range	55 – 88	
Peak Effect in Infra Orbital Region	21 - 30 sec	5	20.8%
	31 - 40 sec	15	62.5%
	41 - 45 sec	4	16.7%
		Mean	SD
	Mean & SD	39	6.4
	Range	30 – 51	

In 3 patients, the time duration was more than 76-90 seconds following the administration of local anesthetic and the mean value was 62.8 with a standard deviation of 9.6. Overall time duration needed for the objective symptoms in the infra orbital fossa was in the infra orbital fossa was more as against in palate. 5 patients needed 21–30 s, 15 needed 31–40 s, and 41–50 s were required in 5 patients with a mean value of 39 s and a standard deviation of 6.4. At evaluation of objective symptoms in the posterior superior alveolar region, the following were the observations: 21–30 s in 16 patients, 31–40 s in 7 patients, 41–45 s in 4 patients. Mean value was 31.71 s and standard deviation of 7.3.Table 5 shows the duration of the anesthetic effect assessed in hours and the mean value obtained was 4.07 with a standard deviation of 0.56.No systemic toxicity or allergic manifestations were reported in any of the patients. There was no incidence of mandibular deviation or alteration in the mouth opening. In two patients, the needle reached 30mm while the anesthesia was secured.1 case of positive aspiration was noted while administering local anesthesia suspecting the needle could have been in the pterygoid plexus.

Table V

Description of the duration of Anaesthesia present obtained time among the study participants			
Anaesthesia	**Time**	**n**	**%**
Duration	3 Hrs	4	14.8%
	4 Hrs	18	66.7%
	5 Hrs	5	18.5%

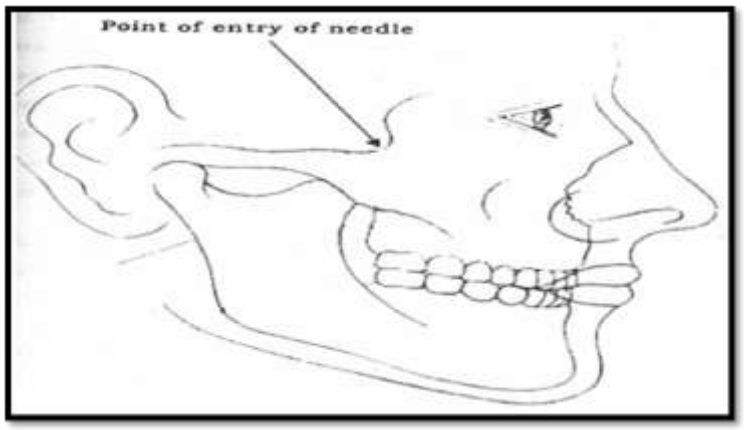
DISCUSSION

Numerous methods have been described in the literature for producing profound regional anesthesia in the maxillary arch. Although they probably work, each has significant drawbacks and none have gained the wide acceptance of the mandibular nerve block [16]. Complete maxillary nerve block is not commonly required (see Indications below). This is because the wide area of anesthesia resulting from maxillary nerve block (including the Dural, temporal, and zygomatic regions; the mucosa of the maxillary sinus; and the maxillary teeth and their soft tissues) is often not needed. Frequently, the area to be blocked is very small (e.g., a single tooth), and the appropriate local anesthesia can be achieved by more specific nerve blocks, which also have the advantage of causing less discomfort to the patient.There are various techniques outlined for rendering anesthesia of the maxillary nerve through extraoral approach and could be classified as suprazygomatic and infrazygomatic techniques. The most popular approach has been via the sigmoid notch: a variant of the infrazygomatic approaches.

EXTRAORAL APPROACHES:

- SUPRAZYGOMATIC APPROACH
- INFRAZYGOMATIC APPROACH

SUPRAZYGOMATIC APPROACH



(Courtesy Kiran Raddar, Ashwin.S, Shreen. F, Chaitanya K, Sayed. Z, Aaisha S; Efficacy and feasibility of frontozygomatic angle approach for Extraoral Maxillary Nerve Block in Oral Surgery)

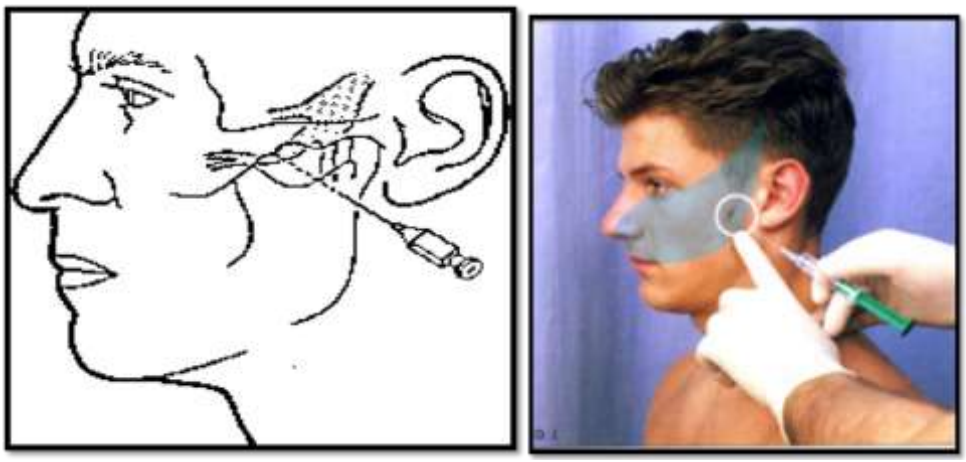
(Courtesy Danilo Jankovic,Philip Peng; Regional nerve blocks in anesthesia and pain therapy, IVTh Edition)

The needle entry point was situated at the skin projection of the frontozygomatic angle—at the angle formed by the superior edge of the zygomatic arch below and the posterior orbital rim forward to the skin and advanced to reach the greater wing of sphenoid bone. After confirming that the needle was in contact with the greater wing of sphenoid bone, it was advanced through the infratemporal fossa angulated at approximately 60° and 10° towards the sagittal and horizontal planes respectively. [3] To avoid pain, 0.2–0.3 ml of local anaesthetic was injected each time before the needle was advanced about 5–8 mm at each attempt. When the rubber marker approached the surface of the skin, patients were instructed to warn the surgeon when they felt local anaesthetic dropping in their nose or throat. This meant that the tip of the needle had reached the posterior wall of the pterygopalatine fossa and penetrated the nasal mucosa.[3]The needle was then withdrawn for 3–5 mm to avoid intranasal injection and after careful aspiration in at least 2 different planes about 30°–40° apart, the remaining drug was slowly deposited into the vicinity of the foramen rotundum where the maxillary nerve leaves the base of the skull to enter the pterygopalatine fossa.[3]

COMPLICATIONS

- Hematoma
- Ecchymosis
- Visual disturbance
- Limitation of mouth opening
- Deviation of the lower jaw
-

INFRAZYGOMATIC APPROACH:



Point of entry of needle

(Courtesy Danilo Jankovic,Philip Peng; Regional nerve blocks in anesthesia and pain therapy, IVTh Edition)
The most important requirement for carrying out the block successfully is accurate location of mandibular fossa between the condylar and coronoid process of the mandible. It is helpful for the patient to open and close the mouth. After skin infiltration, a 6 cm needle is introduced at an angle of 45^0 in the direction back of the eyeball. 4-4.5 cm the lateral part of the pterygoid process is reached and the needle is withdrawn slightly in the pterygopalatine fossa (about 0.5 cm medial to pterygoid). After paraesthesia described above has been elicited and aspiration in various levels, local anesthesia is carefully injected in several doses.

COMPLICATIONS

- Transient visual weakness (Rarely)
- Horner's syndrome (Extremely rare usually occurs due to administration of local anesthesia solution in higher doses)
- Hematoma over the cheek or in the orbital cavity due to blood vessel puncture

With a sparse literature available, of the various extra oral techniques to approach the foramen rotundum, the fronto-zygomatic approach is believed to be safe and efficacious.[3]The present study makes an attempt to evaluate the same. In this study, the mean pain score during the administration of the local anaesthetic, was 2.7 (visual analogue scale) and thus the injection procedure can be considered as painless although 3 patients out of the total sample, experienced a moderate pain which could be attributed to their lower pain threshold. Subjective symptoms in the region of palate were experienced in 22.73 s and infraorbital region the mean time required 18.3 s. The peak anaesthetic effect considered as the mean time needed for the objective symptoms of anesthesia, was 62.8, 39, and 31.71 secs, in palate, infraorbital fossa and the posterior superior alveolar region respectively. The variations in the time duration could be attributable to the varying distances of the respective anatomic sites from the point where the anaesthetic solution was deposited.A majority of the 53 % patients reported no pain during the dental extraction thus favoring the efficacy of the frontozygomatic angle approach. 11 patients experienced a mild pain and 3 patients in whom the nerve block did not achieve owing to failure in the first attempt, scored 3 on VAS (moderate pain). In our study it was noted 11 patients had mild pain and 3 had moderate pain during injection. Mean duration was noted to be 4 hrs. With mean onset of 22.73 sec over palate and 18.3 sec over infraorbital region. There was vascular punctures noted in one patient, without hematoma.The nerve block technique was found to be effective, simple and safe with no incidence of technical failure [27]. This study concluded the mean duration of anesthesia using suprazygomatic approach was 4.07 hrs. Safety of the block could be increased by using a nerve stimulator which could stimulate the temporalis muscle. The pterygopalatine fossa is situated just behind the muscle: and disappearance of the muscular response to direct stimulation with the block needle indicates that its tip is in the infratemporal fossa [27].It is often stated that a deep location of the maxillary nerve trunk at the foramen rotundum makes the regional block using extra oral technique more difficult [11, 4]. In our study in 3 patients, reported with failure to secure anesthesia, while successful anaesthesia was secured in 27 patients in 1st attempt. It could be due to the possible skull variation that is the presence of an enlarged infratemporal tubercle (spinous process) or a relatively narrow entrance to the pterygopalatine fossa (pterygomaxillary fissure) (\2 mm) which may contribute to the difficulty in reaching the injection site [11]In our study 2 cases were reported in which the stopper reached only upto 30 mm and anesthesia was secured suspecting the needle being within the vicinity of foramen Rotundum ,with no postoperative or intraoperative complications were noted except for 1 case of positive aspiration suspecting the needle could have pierced any vessel within the vicinity of the foramen Rotundum.This prospective clinical trial proposes that frontozygomatic angle approach for maxillary nerve block is a safe and reliable technique since it provides an excellent anaesthesia in a relatively larger surgical field with a wide spectrum of indications and is associated with minimal complications which can easily be managed.

CONCLUSION

Although with only dental extraction as the procedure of choice, the present study has favored the frontozygomatic angle approach for the maxillary nerve block as simple, safe, efficacious and associated with minimum and clinically mild complications.

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