Original Research

Locating The Accuracy, Patency, Shape, And Position Of The Greater Palatine Foramen And Assessing Its Importance In Maxillary Nerve Block

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ABSTRACT
Background: GPF (greater palatine foramen) is seen at the articulation of the maxilla and hard palate on its posterior part which continues upward and posteriorly as GPC (greater palatine canal) and has an opening in the pterygopalatine fossa. The maxillary nerve exits the foramen rotundum and enters the pterygopalatine fossa where the nerve can be blocked with high success and low complications. This nerve block is vital for various oral surgical procedures.
Aim: The study was aimed to accurately locate the patency, shape, and position of a greater palatine foramen in Indian subjects that can help in the intraoral maxillary nerve block approach.
Methods: In 60 dried skull bones from adult subjects of both genders, patency, and shape of greater palatine foramen were assessed along with the molar relationship. The data collected were assessed statistically.
Results: The study results depicted that bilaterally on all the skulls, greater palatine foramen was seen opposite to third molars in 91% of the studied skulls. The shape was most commonly found to be oval in 54% of skulls, and the patency rate was found to be 96%.
Conclusion: The study with its data comparison and analysis showed that patency, shape, and position of greater palatine foramen can change based on the racial perspective. The study also showed that it is easier and safer to attain maxillary nerve block through greater palatine foramen owing to the consistency of the patency, shape, and position of the greater palatine foramen in the Indian subjects.
Keywords: Greater palatine canal, Greater palatine foramen, Maxillary nerve, maxillary nerve block, pterygopalatine fossa, regional blocks

INTRODUCTION

The location of the greater palatine foramen is usually in the posterior part of the hard palate and at the articulation of the maxilla bone with the palatine bone (hard palate). The greater palatine foramen moves upwards and posteriorly and shows an opening in the inferior wall of the pterygopalatine fossa.[1] After its exit from the middle cranial fossa, through the foramen rotundum, the maxillary nerve reaches the pterygopalatine fossa. During its exit from the foramen rotundum, the maxillary nerve can be blocked.[2]The role of maxillary nerve block is vital to attain a painless intraoperative field during various oral surgical procedures involving tooth extraction and other surgeries performed in the maxillary region. Both extra-oral and intra-oral routes can be utilized to get a maxillary nerve block.[3] During the use of the intraoral approach for the maxillary nerve block with local anesthesia, it can be administered with two techniques, either through the greater palatine foramen or using a high tuberosity technique around the tuberosity.[4] The approach of the greater palatine canal via greater palatine foramen is done by injecting the local anesthetic agent in the pterygopalatine fossa to attain the maxillary nerve block. Using the intraoral route, the greater palatine foramen is a preferred route for the maxillary nerve block as it is associated with lesser complications including over-needle insertion and hematoma which are commonly seen with the high tuberosity approach.[5] Also, the greater palatine foramen approach has high rates of success if used with accurate anatomic knowledge of the greater

palatine canal and greater palatine foramen.[6] The greater palatine foramen approach and the procedure is the most acceptable method for maxillary nerve block for attaining the proper anesthesia during various procedures performed in the maxilla region. This block is also vital for therapeutic and diagnostic procedures performed in various neuralgias such as trigeminal neuralgia.[7]To achieve local anesthesia in the hemi-maxilla including the part of the nose, mouth, and teeth, a maxillary nerve block is used. With the maxillary nerve block, complete hemimaxilla anesthesia is achieved with a minimum penetration of the needle and deposition of lesser anesthetic volume in comparison to the 4 injections administered.[8] For the greater palatine canal approach, wide the wide-open mouth of the subject, the needle is placed next to the maxillary second molar on the palate. The small quantity of the anesthetic agent has then deposited after the needle contracts the hard palate. The effect of the anesthesia can be seen after 5 minutes, and the needle is then reinserted and advanced through the foramen to the canal and following injection of local anesthetic agent, the needle is gradually withdrawn.[9]The location is highly variable for greater palatine foramen based on the race of the subject being assessed. The present study was aimed at locating the accurate and precise position for the greater palatine foramen that can help in the intra-oral approach for the maxillary nerve block through the greater palatine foramen.

MATERIALS AND METHODS

The present anatomical study was aimed to accurately locate the patency, shape, and position of a greater palatine foramen in Indian subjects that can help in the intraoral maxillary nerve block approach. The study was done at Government Medical College. The dried human skulls for the study were collected from the Department of Anatomy of the Institute.The study assessed 60 dried skulls from human subjects irrespective of the gender of the skulls. The inclusion criteria for the skulls were the skulls without any gross distortion, pathology, or erosion, and the skulls with identifiable greater palatine foramen. The skulls for inclusion were identified as adult skulls by assessing the eruption of the third molars in the skulls being assessed. The skulls were not considered for the study if they have a difficult identification of the greater palatine foramen, skulls of subjects with associated bony pathologies, skulls with distortion or associated pathology, and skulls that did not belong to the adult subjects.After the final inclusion of the skulls to be assessed in the present study, the molar relation was identified in all 60 skulls. This was followed by an assessment of the shape and patency of the greater palatine foramen. Two examiners expertized in the field recorded the molar relationship. The same examiners also recorded the shape of the greater palatine foramen by simple observation. A 24-gauge orthodontic wire was used to assess the patency of the greater palatine foramen where the orthodontic wire was utilized as the probe.The data gathered was analyzed statistically and the results were expressed in the number and percentages. The data were tabulated and the results were formulated aimed at locating the accurate and precise position for the greater palatine foramen that can help in the intra-oral approach for the maxillary nerve block through the greater palatine foramen.

RESULTS

The present anatomical study was aimed to accurately locate the patency, shape, and position of a greater palatine foramen in Indian subjects that can help in the intraoral maxillary nerve block approach. The study assessed 60 dried skulls from human subjects irrespective of the gender of the skulls. The molar relationship for the present study for greater palatine foramen was assessed and classified for the three different positions as follows: distal to the 3rd molar, opposite to the 3rd molar, and opposite to the second molar. The study results showed that the molar relationship in greater palatine foramen was distal to the 3rd molar in 3.33% (n=2) skulls on the left side and in 10% (n=6) skulls on the right side. The molar relation was found to be opposite to the 3rd molar in 93.3% (n=56) skulls on the left side and 86.6% (n=52) skulls on the right side, and was opposed to the second molar in 3.33% (n=2) skulls on the left side and right side each as shown in Table 1.On recording the shape of the greater palatine foramen in the 60 skulls in the study, the slit shape was seen in 16.6% (n=10) skulls on the left side and 10% (n=6) skulls on the right side. The round shape among the 60 skulls was seen in 33.3% (n=20) skulls on right and left sides each. The oval shape of the greater palatine foramen was seen in 50% (n=30) skulls on the left side and in 56.6% (n=34) skulls on the right side as depicted in Table 2.Concerning the patency of the greater palatine foramen in the 60 skulls assessed in the present study, it was noted that on the left side of the skulls, patency can be recorded in the 93.3% (n=56) of the human dried skulls and was not seen in 6.6% (n=4) human skulls assessed in the study. However, on the right side of the 60 skulls assessed in the present study, it was seen that the patency can be noted in 96.6% (n=58) human dried skulls and could not be seen in 3.33% (n=2) human dried skulls evaluated in the present study as shown in Table 3. Image 1 shows Molar relationship of greater palatine foramen - Opposite to the 3rd molar, shape is oval on both side also Image 2 shows molar relationship of greater palatine foramen - Opposite to the 3rd molar, shape is slit type on right side and round on left at the end of this literature.

TABLES

Side	Molar relationship		
	Distal to the 3rd molar n (%)	Opposite to the 3rd molar n (%)	Opposite to the 2nd molar n (%)
Left side	2 (3.33)	56 (93.3)	2 (3.33)
Right side	6 (10)	52 (86.6)	2 (3.33)

Table 1: Molar relationship of the greater palatine foramen

Side	Shape		
	Slit	Round	Oval
Left side	10 (16.6)	20 (33.3)	30 (50)
Right side	6 (10)	20 (33.3)	34 (56.6)

Table 2: Shape of the greater palatine foramen in the study skulls

Side	Patency	
	Yes	No
Left side	56 (93.3)	4 (6.6)
Right side	58 (96.6)	2 (3.33)

Table 3: Patency of the greater palatine foramen in the study skulls

Image 1- Molar relationship of greater palatine foramen - Opposite to the 3rd molar, Shape - oval on both side

Image 2- Molar relationship of greater palatine foramen - Opposite to the 3rd molar, Shape- Slit type on right side and round on left

DISCUSSION

The present study aimed to accurately locate the patency, shape, and position of a greater palatine foramen in Indian subjects that can help in the intraoral maxillary nerve block approach. In 60 dried skull bones from adult subjects of both genders, patency and shape of greater palatine foramen were assessed along with the molar relationship. The data collected were assessed statistically. The study results showed that in the majority of the assessed skulls, the molar relation was found to be opposite to the third molars in 93.3% (n=56) skulls on the left side and 86.6% (n=52) skulls on the right side, distal to the 3rd molar in 3.33% (n=2) skulls on the left side and in 10% (n=6) skulls on the right side, and was opposite to the second molar in 3.33% (n=2) skulls on the left side and right side each. These results were consistent with the previous studies by Ajmani ML[10] in 1994, Saralaya V et al[11] in 2007, Westmoreland EE et al[12] in 1982, and Hassanali J et al[13] in 1984 where authors reported the molar relation opposite to 3rd molar in 64.70%, 74.60%, 76%, and 57% of skulls in their respective studies.For the shape of the greater palatine foramen in the study skulls, the most commonly seen was the oval shape of the greater palatine foramen was seen in 50% (n=30) skulls on the left side and in 56.6% (n=34) skulls on the right side followed by the round shape among the 60 skulls was seen in 33.3% (n=20) skulls on right and left side each, and least was slit shape seen in 16.6% (n=10) skulls on the left side and 10% (n=6) skulls on the right side. These results agreed with the previous work of Methathrathip D et al [14] in 2005, Cheung LK et al[15] in 2008, and Langenegger JJ et al[16] in 1983 where authors reported the most common shape of the greater palatine foramen to be the oval shape. The least common shape seen in the skulls was a slit shape for the greater palatine foramen which may pose difficult negotiation of the greater palatine canal through the greater palatine foramen while performing the maxillary nerve block.Concerning the patency of the greater palatine foramen in the human dried skulls assessed in the present study, it was noted that on the left side of the skulls, patency can be recorded in the 93.3% (n=56) of the human dried skulls and was not seen in 6.6% (n=4) human skulls assessed in the study. However, on the right side of the 60 skulls assessed in the present study, it was seen that the patency can be noted in 96.6% (n=58) human dried skulls and could not be seen in 3.33% (n=2) human dried skulls evaluated in the present study. These results were in line with the Malamed SF et al[17] in 1983 where authors reported the patency of greater palatine foramen to be 97.55%. The results for the patency depict that greater palatine foramen can be blind in nearly 5% of the subjects and this should be kept in consideration while giving maxillary nerve block in the Indian subjects.

CONCLUSION

The maxillary nerve block has wide applications in the surgical procedures performed in the maxilla and in subjects where local anesthesia cannot be injected including cases of congenital repair of the cleft palate, maxillary cancer, extensive trauma of the maxilla, infection, abscess cases, and cases where pain relief is needed postoperatively following the surgeries of the maxilla region. Maxillary nerve block through the greater palatine foramen and the greater palatine canal is a successful and safe technique with proper anatomic knowledge concerning the patency, shape, and position of the greater palatine foramen. The present study showed that the patency, shape, and position of the greater palatine foramen can differ in different individuals. The study results also showed that the maxillary nerve block through the greater palatine foramen is an easy and safe technique owing to the consistency in the patency, shape, and position of the greater palatine foramen in the Indian subjects.

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