Review Article

Prevalence of Bifid Mandibular Canal

B. Sowndarya*
Saveetha Dental College and Hospitals, Saveetha University, 162, P.H Road, Chennai, Tamil Nadu, India.
***Corresponding author's E-mail:** sowndaryabaskaran@gmail.com

Accepted on: 16-06-2016; **Finalized on:** 31-08-2016.

ABSTRACT

The determination of the location of the mandibular canal and the identification of any anatomical variations that relate to it, i.e., accessory foramina and canals, is one of the most important things to the clinician prior to any surgical procedures. Accessory mandibular foramina refer to any openings in the bone other than the sockets of the teeth, the mandibular foramina, the mental foramina and the lingual foramen. surgeries in these areas can be done properly only when the structures are identified properly otherwise it leads to adverse consequences. Although the presence of accessory mandibular foramina and canals is often ignored by, or receives little attention, in many anatomy textbooks, there are numerous reports in the literature. These anatomical variations can only be found in clinical practice by radiography.

Keywords: mandibular canal, CT, CBCT, radiography.

INTRODUCTION

The determination of the location of the mandibular canal and the identification of any anatomical variations that relate to it, i.e., accessory foramina and canals, is one of the most important thing to the clinician prior to any surgical procedures. Accessory mandibular foramina refer to any openings in the bone other than the sockets of the teeth, the mandibular foramina, the mental foramina and the lingual foramen.[1] Surgeries in these areas can be done properly only when the structures are identified properly otherwise it leads to adverse consequences. Although the presence of accessory mandibular foramina and canals is often ignored by, or receives little attention, in many anatomy textbooks, there are numerous reports in the literature. These anatomical variations can only be found in clinical practice by radiography. To date, all previous radiographic studies have utilized two-dimensional radiography, mostly panoramic radiographs. The mandibular canal which contains the inferior alveolar nerve and neurovascular is located between the mandibular and mental foramina, and bundle. It's shape is either oval, circular or pyriform. The canal has the shape of a concave curve as the posterior part is descending and the anterior part is ascending towards the mental foramen.[1-3] In their textbook, Sicher and Dubrul[4] refer briefly to anatomical variations in the mandible and state that the mylohyoid nerve is known to contain sensory fibers to the chin and occasionally sends a branch into the mandible. This branch enters the bone through a foramen located in the mental region on the lingual aspect, not far from the midline and just above the lower border of the mandible. According to the same authors, another anatomical variation exists in rare area. This branch is normally given shortly after the inferior alveolar nerve has entered the mandibular canal. Sometimes, however, the posterior dental branch arises from the anterior surface of the inferior alveolar nerve above the mandibular foramen, and enters the mandible via a small foramen in front of and above the mandibular foramen. There have been numerous reports on mandibular accessory canals and foramina. The literature can be divided into radiographic studies, anatomical studies (including dissection and examination of dry mandibles), combination of the two and case reports.

Classification

From studies on a large number of occurrences, it was possible to establish classifications based on panoramic radiographs. Nortje first described three configurations of these bifid canals, to which a fourth type[6] was later added. This classification would later be confirmed by Heasman. In 1985, Langlais established a system of classification into four groups according to the anatomical parameters. They stressed that the mandibular canals could present small and as yet unlisted supplementary accessory canals.

Retrospective Studies of Frequency

Table 1: Studies of frequency of double mandibular canals with panoramic radiographs.

	Number of cases studied	Frequency of double canals (%)
Nortje	3612	0.9
Durst and Snow	1024	8.3
Grover and Lorton	5000	0.08
Langlais	6000	0.95
Zografos	700	0.4
Sanchis	2012	0.35

The discovery of these anatomical particularities has led practitioners or researchers to study how frequently they occur. All such research studies have been carried out on panoramic radiographs. Between 1977 and 2003, we found six publications on the subject (Table 1), with the frequency of the occurrence of double mandibular canals ranging between 0.08% and 8.3%. Given such a disparity in results, we feel we must be sceptical as to the type of study used.

Prevalence

The accessory foramina and canals of mandible are some of the important anatomical variation which leads surgical complications, if its not identified properly. Haemorrhage, impairing of the surgeon's visibility are some and increase of fibrous tissue formation at the site of contact with an implant are some of the complications caused by these anatomical structures during surgical intrusion. Dysesthesia is also experienced by the patient.[33] Large variations exist in the size of mandibular accessory foramina. They may be as small as 0.1 mm or reach a width of more than 1.5 mm[5] and often resemble the original foramina in size.[6] Smaller foramina are rarely measured because they are indistinguishable from the normal porous appearance.[7] Other than these there are some other variations which are associated with number. Some mandibles may have none,[1] while in rare instances in one mandible up to 100 foramina were observed.[7] The differences in size and number may be explained by different inclusion criteria for size and different methods of evaluation. The dissection and examination of dry mandibles would give a result with more degree of accuracy but most of the studies have used radiographic evaluation method where some of the foramen aren't visible so it isn't that accurate. Most of the foramina are present in posterior areas of the mandible and to a lesser degree in the symphysis, this is what is the idea or conclusion of most of the studies and are much more frequent on the internal than the external surface of the mandible.[1,8,7] An important link or connection has also been found between location of accessory foramina and area of insertion of the muscles of mastication.[10] The discussion on symmetry of accessory canals and foramina hasn't came into a conclusion yet. While most authors believe that bilateral symmetry exists,[1,9,12,15] others do not.[11] Racial differences may affect the prevalence of accessory foramina. Some races, e.g., the native population of North America, may have more foramina than others.[14] However, no gender differences have been discovered.[12,8,13] Apparently, prevalence is affected by age with a marked peak in adolescence which may reflect increased neurovascular requirements related to the adolescent growth-spurt.[14] A question also exists regarding the contents of the accessory foramina and canals. Obviously, it can only be resolved by dissection. Myelinated nerves, neurovascular bundles, one or more arterioles and one or more venules have been found to occupy these canals and foramina.[1,4,10] Uncertainty also remains regarding the direction of these structures, whether they are entering or exiting the bone. The presence of accessory innervation may explain failures to achieve adequate levels of anaesthesia during surgical and routine dental procedures using conventional nerve block techniques.[1,4,9,10] The nerves that have been associated with difficulties in obtaining adequate levels of local anaesthesia in the mandible include the posterior dental branch and the mylohyoid, buccal, transverse cutaneous and auriculotemporal nerves.[1,4] Another possible indication for the direction of the anatomical structures inside the accessory canals may be changes in the diameter of the accessory canals, as was demonstrated in our case. It is conceivable that the direction would be from the point of larger to the point of smaller diameter. Therefore, in our case, the accessory canal on the right side of the mandible was branching of from the inferior alveolar canal. The fact that there was a dramatic reduction in the diameter of the mandibular canal anterior at its junction with the accessory canal supports this theory. However, the direction on the other side could not be determined using this criterion.

The foramina in our case were located on the crest of the alveolar bone in the body of mandible anterior to the ascending ramus, were 1±2 mm in diameter and relatively symmetrical. Although the foramina and canals were located in edentulous areas, judging from their location they appear similar to the mandibular retromolar canals and foramina that have been described previously.[10,12,14]

The most accurate way to diagnose the presence of accessory foramina and canals is by visual inspection during dissection or by examination of dry mandibles. However, this method is not applicable to patient management.

The only option available for the clinician is to use radiographs.

Most of the studies that have evaluated the presence of accessory foramina and canals radiographically have been based on panoramic radiographs.[9,7,17,8]

The use of two-dimensional radiography may cause underestimation in the identification of these anatomical structures[17,7] and they can often be overlooked as can be seen from their relatively low occurrence compared with anatomical studies.

Many studies have demonstrated greater reliability and accuracy of CT over two-dimensional radiography.[34±38]

However, no study has utilized CT to diagnose accessory canals and foramina in the mandible.

This report clearly demonstrates the advantage of CT over panoramic radiography in identification of anatomical variations and is the first to demonstrate these important anatomical variations in this way.

CONCLUSION

The location and configuration of the mandibular canal should be carefully observed using cross-sectional images of the mandibular canal and images perpendicular to them, reconstructed by CBCT,as they are clinically very significant. This will be so useful for surgical procedures involving mandible such as implant treatment.

REFERENCES

1. Sutton RN. The practical significance of mandibular accessory foramina. Aust Dent J, 19, 1974, 167-173.
2. Anderson LC, Kosinski TF, Mentag PJ. A review of the intraosseous course of the nerves of the mandible. J Oral Implantol, 17, 1991, 394-403.
3. Rajchel J, Ellis E, Fonseca RJ. The anatomical location of the mandibular canal: its relationship to the sagittal ramus osteotomy. Int J Adult Orthodon Orthognath Surg, 1, 1986, 37-47.
4. Sicher H, Dubrul EL. Oral Anatomy, 7th ed, St. Louis. The C. V. Mosby Company. 1980, 468.
5. Shiller WR, Wiswell OB. Lingual foramina of the mandible. Anat Rec, 119, 1954, 387-390.
6. Serman NJ. An Osteo-radiographic study of the mandibular canal. M.S. Thesis. University of Stellenbosch. S. Africa. 1982, 77-108.
7. Haveman CW, Tebo HG. Posterior accessory foramina of the human mandible. J Prosthet Dent, 35, 1976, 462-468.
8. Carter RB, Keen EN. The intramandibular course of the inferior alveolar nerve. J Anat, 108, 1971, 433-440.
9. NortjeÂ CJ, Farman AG, Grotepass FW. Variations in the normal anatomy of the inferior dental (mandibular) canal: A retrospective study of panoramic radiographs from 3612 routine dental patients. Br J Oral Surg, 15, 1977, 55-63.
10. Langlais RP, Broadus R, Glass BJ. Bi®d mandibular canals in radiographs. J Am Dent Assoc, 110, 1985, 923-926.
11. Ossenberg NS. Retromolar foramen of the human mandible. Am J Phys Anthropol, 73, 1987, 119-128.
12. Durst JH, Snow JM. Multiple mandibular canals; oddities or fairly common anomalies. Oral Surg Oral Med Oral Pathol, 49, 1980, 272-273.
13. Serman NJ. An Osteo-radiographic study of the mandibular canal. M.S. Thesis. University of Stellenbosch. S. Africa. 1982, 77-108.
14. Pattersen JE, Jordan WW. Aberrant canal to mandibular third molar area. Oral Surg Oral Med Oral Pathol, 44, 1977, 487-488.
15. Pattersen JE, Jordan WW. Aberrant canal to mandibular third molar area. Oral Surg Oral Med Oral Pathol, 44, 1977, 487-488.
16. Schejtman R, Devoto FCH, Arias NH. The origin and distribution of the elements of the human mandibular retromolar canal. Arch Oral Biol, 12, 1967, 1261-1267.
17. Busch HA. Investigations on an unnamed foramen in mandible. J Indian Dent Assoc, 50, 1978, 273-275.
18. Nortje´ CJ, Farman AG, Grotepass FW. Variations in the normal anatomy of the inferior dental (mandibular) canal: a retrospective study of panoramic radiographs from 3612 routine dental patients. Br J Oral Surg, 15, 1977, 55–63.
19. Durst JH, Snow JE. Multiple mandibular canals: oddities or fairly common anomalies? Oral Surg Oral Med Oral Pathol, 49, 1980, 272–273.
20. Grover PS, Lorton L. Bifid mandibular nerve as a possible cause of inadequate anesthesia in the mandible. J Oral Maxillofac Surg 41, 1983, 177–179.
21. Langlais RP, Broadus R, Glass BJ. Bifid mandibular canals in panoramic radiographs. J Am Dent Assoc, 110, 1985, 923–926.
22. Zografos J, Kolokoudias M, Papadakis E. Thetypesofmandibularcanal. Hell Period Stomat Gnathopathoprosopike Cheir, 5, 1990, 17.
23. Sanchis JM, Pen ˜arrocha M, Soler F. Bifid Mandibular Canal. J Oral Maxillofac Surg, 61, 2003, 422–424.

Source of Support: Nil, **Conflict of Interest:** None.