International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 04 Issue 12 December 2024

Page No: 2188-2191

DOI: https://doi.org/10.47191/ijmscrs/v4-i12-15, Impact Factor: 7.949

Bifid and Trifid Mandibular Canals: Are they Uncommon or Underestimated?

Georges Aoun[1], Wissam Sharrouf[2]

[1]Dean, Faculty of Dental Medicine, Lebanese University, Beirut, Lebanon

Professor, Department of Oral Medicine and Maxillofacial Radiology, Faculty of Dental Medicine, Lebanese University, Beirut, Lebanon

[2]Department of Oral Medicine and Maxillofacial Radiology, Faculty of Dental Medicine, Lebanese University, Beirut, Lebanon

ABSTRACT

Anatomical variations of the mandibular canal (MC) such as bifid MC (BMC) and trifid MC (TMC) have been largely reported in the scientific literature. They are characterized by two or three accessory canals running roughly parallel to MC. BMC and TMC are incidentally detected during routine dental radiography, and their thorough understanding is necessary to the practitioner to avoid complications during dental procedures. This paper aims to review BMC and TMC and to provide basic knowledge for dental clinical procedures.

KEYWORDS: Bifid, trifid, mandibular canal, panoramic radiograph, cone-beam computed tomography

ARTICLE DETAILS

Published On:
06 December 2024

Available on:
https://ijmscr.org/

INTRODUCTION

The mandibular canal (MC) houses the inferior alveolar nerve, which is a branch of the mandibular nerve (the third division of the trigeminal nerve), and the inferior alveolar vessels [1]. It runs along the body of the mandible and terminates at the mandibular foramen on the medial aspect of the ramus [2]. MC can exhibit a circular, oval, or piriform shape [3].

Knowledge of MC anatomy and location is crucial for successful dental procedures, such as inferior alveolar nerve block, implant placement, surgical dental extraction, especially wisdom teeth, etc. [4].

Anatomical variations of MC such as bifid MC (BMC) and more rarely trifid MC (TMC) have been reported in the scientific literature [5-10]. BMC and TMC are characterized by a canal with two (Figure 1) or three accessory canals running roughly parallel to MC [6, 10, 11]; these accessory canals result from ossification around minor branches, sometimes large enough, coming from the inferior alveolar nerve.

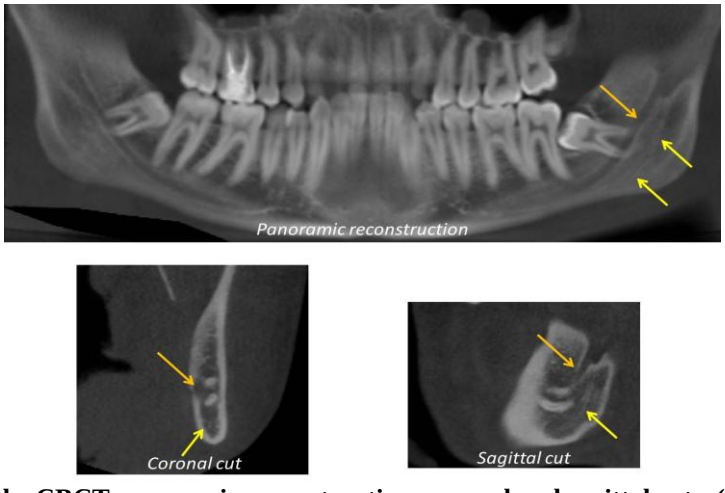

Figure 1: BMC as seen on the CBCT panoramic reconstruction, coronal and sagittal cuts. (Collection Dr. Ibrahim Nasseh)

BMCs and TMCs do not have any clinical signs; they are fortuitously detected on conventional imaging techniques used in dental practice, such as panoramic radiography and cone-beam computed tomography (CBCT), which provides a more precise evaluation [10]. In fact, the panoramic 2D X-ray has limitations in exhibiting intraosseous structures such as MC, whose visibility may decrease when its borders become undetectable due to a poor bone density or a non-perpendicularity between the canal and the principal beam. Additionally, lesser resolution, elevated distortion, and the risk of phantom images are also main disadvantages of this technique.

This paper aims to review BMC and TMC and to provide basic knowledge for dental clinical procedures.

BIFID MANDIBULAR CANAL

BMC was evaluated by many authors by means of different radiographic techniques. Panoramic radiographs were used by Kalantar Motamedi et al. [12], Nortje et al. [6], and Langlais et al. [5], who found respectively a prevalence of 1.22% of BMC (61/5000), 0.91% (33/3612), and 0.95% (57/6000). In the same way, studies conducted by Grover and Lorton [13], Sanchiz et al. [14], and Kuczynski et al. [15] found that the prevalence of BMC was respectively 0.08% (4/5000), 0.35% (7/2012), and 1.98% (60/3024).

A higher incidence was reported by Miličević et al. [16] 4.66% (47/1008), Fuentes et al. [17] 11.02% (102/925) [16], and de Freitas et al. [18] 6% (30/500).

Nowadays, as imaging techniques like CBCT have advanced technologically, more details are provided, leading to better evaluation. Therefore, a number of studies suggest that using panoramic radiography alone underestimates the incidence of BMC [7, 11, 19]. Kuribayashi et al. believe that because panoramic radiographs are unable to detect all canals, particularly narrow ones, the incidence of BMC may be higher when utilizing CBCT. According to their study, 15.61% of people had BMC (47/301) [7]. Likewise, Klinge et al. [20], in their cadaveric study, found that panoramic images were unsuccessful to identify the MC in 36.1% of cases compared to CT scans, and Bogdán et al. [21] observed that on their sample of 46 dry mandibles, 9 BMCs (19.6%) were detectable, of which only 0.2% were visible on panoramic radiographs. On the other hand, on panoramic images, some anatomical structures may mimic BMCs, such as the groove of the mylohyoid nerve located on the deep medial surface of the ramus or some intra-bony dense trabecular formations [22-24].

Concerning the types of BMC, many classifications have been suggested by different authors, among others Nortjé et al. [6], Naitoh et al. [25], and Langlais et al. [5], whose classification remains the most cited in the literature and divides BMCs into four types according to their locations and shapes (Table 1).

Table 1: BMC classification according to Langlais et al

Type of BMC	Description
Type 1	- Unilateral extending to the region of the third molar - Bilateral extending to the region of the third molar
Type 2	- Unilateral extending along the main canal and then coming together in the mandibular rami - Unilateral extending along the main canal and then coming together in the mandibular body - Bilateral extending along the main canal and then coming together in the mandibular rami - Bilateral extending along the main canal and then coming together in the mandibular body
Type 3	Combination between types 1 and 2
Type 4	Two canals from two distinct origins, and then joining to form a single, large MC

The BMC type that extends to the third molar region is the most common, according to many authors [26, 27].

TRIFID MANDIBULAR CANAL

TMC, which has been reported several years after BMC, is the second most commonly described mandibular canal variant in the scientific literature [22]. To date, many studies have been conducted on TMC prevalence using different methods and populations. In their assessment of 925 digital panoramic radiographs, Fuentes et al. [17] could not find any TMC. This is most likely because of the limitation of a two-dimensional imaging modality. On the other hand, Bogdán et al. found one case of TMC among the 46 dry mandibles they examined (2.17%) [21]. Similar prevalence (2.4%) was found by Okumuş and Dumlu, who investigated a sample of the Turkish population using CBCT [28]. Other studies assessed the MC anatomical variants in other populations, such as Rashsuren et al. [29], who found 7 TMCs in 500 Korean patients (1.4%), and Yang et al. [30], who reported a prevalence of 1.1% among Han Chinese in Shanghai.

Similar to BMC, TMC was detected either unilaterally or bilaterally and in several mandibular locations [10].

CONCLUSION

Although they are regarded as uncommon anatomical variations, BMC and TMC can be found in any patient and need to be properly evaluated. Yet if routine panoramic radiographs are widely recommended before many dental and oral procedures, CBCT is considered more accurate for distinguishing true BMC and TMC from false positives.

REFERENCES

I. Muñoz G, Dias FJ, Weber B, Betancourt P, Borie E. Anatomic relationships of mandibular canal. A cone beam CT study. Int J Morphol. 2017; 35(4):1243-8.

II. Iwanaga J, Shiromoto K, Kato T, Tanaka T, Ibaragi S, Tubbs RS. Anatomy of the mandibular canal and surrounding structures. Part II: Cancellous pattern of the mandible. Ann Anat. 2020;232:151583. doi: 10.1016/j.aanat.2020.151583.

III. Suazo GI, Matamala ZD. Cantín LM. Accessory mandibular canal: analysis of prevalence and imaging appearance. Av Odontoestomatol. 2011; 27(2):85-90.

IV. Juodzbalys G, Wang HL, Sabalys G. Injury of the inferior alveolar nerve during implant placement: a literature review. J Oral Maxillofac Res. 2011; 2(1):e1. doi: 10.5037/jomr.2011.2101.

V. Langlais RP, Broadus R, Glass BJ. Bifid mandibular canals in panoramic radiographs. J Am Dent Assoc. 1985 Jun; 110(6):923-6. doi: 10.14219/jada.archive.1985.0033. PMID: 3860553.

VI. Nortjé 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. 1977; 15(1):55-63. doi: 10.1016/0007-117x(77)90008-7.

VII. Kuribayashi A, Watanabe H, Imaizumi A, Tantanapornkul W, Katakami K, Kurabayashi T. Bifid mandibular canals: cone beam computed tomography evaluation. Dentomaxillofac Radiol. 2010; 39(4):235-9. doi: 10.1259/dmfr/66254780.

VIII. Mizbah K, Gerlach N, Maal TJ, Bergé SJ, Meijer GJ. Canalis mandibulae bifidus en trifidus. Een toevalsbevinding [Bifid and trifid mandibular canal. A coincidental finding]. Ned Tijdschr Tandheelkd. 2010; 117(12):616-8. Dutch. doi: 10.5177/ntvt.2010.12.10155.

IX. Aljunid S, AlSiweedi S, Nambiar P, Chai WL, Ngeow WC. The management of persistent pain from a branch of the trifid mandibular canal due to implant impingement. J Oral Implantol. 2016; 42(4):349-52. doi: 10.1563/aaid-joi-D-16-00011.

X. Al-Siweedi SYA, Ngeow WC, Nambiar P, Abu-Hassan MI, Ahmad R, Asif MK, Chai WL. A new classification system of trifid mandibular canal derived from Malaysian population. Folia Morphol (Warsz). 2023; 82(2):315-24. doi: 10.5603/FM.a2022.0024.

XI. Soman C, Wahass T, Alahmari H, Alamri N, Albiebi A, Alhabashy M, et al. Prevalence and characterization of bifid mandibular canal using cone beam computed tomography: a retrospective cross-sectional study in Saudi Arabia. Clin Cosmet Investig Dent. 2022; 14:297-306. doi: 10.2147/CCIDE.S386098.

XII. Kalantar Motamedi MH, Navi F, Sarabi N. Bifid mandibular canals: prevalence and implications. J Oral Maxillofac Surg. 2015; 73(3):387-90. doi: 10.1016/j.joms.2014.09.011.

XIII. Grover PS, Lorton L. Bifid mandibular nerve as a possible cause of inadequate anaesthesia in the mandible. J Oral Maxillofac Surg. 1983; 41:177-9.

XIV. Sanchis JM, Peñarrocha M, Soler F. Bifid mandibular canal. J Oral Maxillofac Surg. 2003; 61(4):422-4. doi: 10.1053/joms.2003.50004.

XV. Kuczynski A, Kucharski W, Franco A, Westphalen FH, de Lima AA, Fernandes A. Prevalence of bifid mandibular canals in panoramic radiographs: a maxillofacial surgical scope. Surg Radiol Anat. 2014; 36(9):847-50. doi: 10.1007/s00276-014-1298-2.

XVI. Miličević A, Salarić I, Đanić P, Miličević H, Macan K, Orihovac Ž, et al. Anatomical variations of the bifid mandibular canal on panoramic radiographs in citizens from Zagreb, Croatia. Acta Stomatol Croat. 2021; 55(3):248-55. doi: 10.15644/asc55/3/2.

XVII. Fuentes R, Arias A, Farfán C, Astete N, Garay I, Navarro P, Dias FJ. Morphological variations of the mandibular canal in digital panoramic radiographs: a retrospective study in a Chilean population. Folia Morphol (Warsz). 2019; 78(1):163-70. doi: 10.5603/FM.a2018.0058.

XVIII. de Freitas GB, de Morais Silva PG, dos Santos JA, Manhães Júnior LRC, Bernardon P. Prevalence and classification of anatomical variations of mandibular canal in panoramic radiographies. J Health Sci. 2020; 10(2):133-8.

XIX. Kang JH, Lee KS, Oh MG, Choi HY, Lee SR, Oh SH, et al. The incidence and configuration of the bifid mandibular canal in Koreans by using cone-beam computed tomography. Imaging Sci Dent. 2014; 44(1):53-60. doi: 10.5624/isd.2014.44.1.53.

XX. Klinge B, Petersson A, Maly P. Location of the mandibular canal: comparison of macroscopic findings, conventional radiography, and computed tomography. Int J Oral Maxillofac Implants. 1989; 4(4):327-32.

XXI. Bogdán S, Pataky L, Barabás J, Németh Z, Huszár T, Szabó G. Atypical courses of the mandibular canal: comparative examination of dry mandibles and x-rays. J Craniofac Surg. 2006; 17(3):487-91. doi: 10.1097/00001665-200605000-00017.

XXII. Ngeow WC, Chai WL. The clinical anatomy of accessory mandibular canal in dentistry. Clin Anat. 2020; 33(8):1214-27. doi: 10.1002/ca.23567.

XXIII. Kim MS, Yoon SJ, Park HW, Kang JH, Yang SY, Moon YH, et al. A false presence of bifid

mandibular canals in panoramic radiographs. Dentomaxillofac Radiol. 2011; 40(7):434-8. doi: 10.1259/dmfr/87414410.

XXIV. Sarkar S, Mondal S. Bifid mandibular canals: a case report and mini review. J Clin Adv Dent. 2020; 4:006-8. doi: 10.29328/journal.jcad.1001015

XXV. Naitoh M, Hiraiwa Y, Aimiya H, Ariji E. Observation of bifid mandibular canal using cone-beam computerized tomography. Int J Oral Maxillofac Implants. 2009; 24(1):155-9.

XXVI. Fu E, Peng M, Chiang CY, Tu HP, Lin YS, Shen EC. Bifid mandibular canals and the factors associated with their presence: a medical computed tomography evaluation in a Taiwanese population. Clin Oral Implants Res. 2014; 25(2):e64-7. doi: 10.1111/clr.12049.

XXVII. Correr GM, Iwanko D, Leonardi DP, Ulbrich LM, Araújo MR, Deliberador TM. Classification of bifid mandibular canals using cone beam computed tomography. Braz Oral Res. 2013; 27(6):510-6. doi: 10.1590/S1806-83242013000600011.

XXVIII. Okumuş Ö, Dumlu A. Prevalence of bifid mandibular canal according to gender, type and side. J Dent Sci. 2019; 14(2):126-33. doi: 10.1016/j.jds.2019.03.009.

XXIX. Rashsuren O, Choi JW, Han WJ, Kim EK. Assessment of bifid and trifid mandibular canals using cone-beam computed tomography. Imaging Sci Dent. 2014; 44(3):229-36. doi: 10.5624/isd.2014.44.3.229.

XXX. Yang X, Lyu C, Zou D. Bifid mandibular canals incidence and anatomical variations in the population of shanghai area by cone beam computed tomography. J Comput Assist Tomogr. 2017; 41(4):535-40. doi: 10.1097/RCT.0000000000000561.