

ORIGINAL COMMUNICATION

Mandibular canal vs. inferior alveolar canal: Evidence-based terminology analysis

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Abstract

Introduction: The mandibular canal, as it was formerly named in *Terminologia Anatomica (TA)*, has also been called the inferior alveolar (nerve) canal in many scientific publications. This study was conducted to investigate how these terms have been understood in different regions and different areas of expertise and to discuss the appropriate future application of the term “mandibular canal.”**Methods:** A literature search was conducted using PubMed, and articles using different terms for this structure were classified into two groups, inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) and the mandibular canal (MC). The 50 most recent articles in each group were included. Publication year, journal title, country of the first author, and affiliation of all authors were recorded in both groups for all 100 articles.**Results:** There was a significant difference between the IAC/IANC and MC groups in the numbers of anatomy journals, other journals, and anatomy affiliations. Turkey published most frequently with a total of 15 articles, followed by Iran with 10 articles, and China/India/United States with seven each. When the six countries of the first author that had three or more publications in each group were compared, only Turkey appeared in both groups; otherwise, different countries were in the two groups.**Conclusions:** Based on the results of this analysis, and considering that the tentative new term “inferior alveolar foramen” is used in the latest *TA*, we suggest that the mandibular canal should be renamed the “inferior alveolar canal.”

KEYWORDS

dentistry, inferior alveolar canal, inferior alveolar foramen, mandibular canal, mandibular foramen, *Terminologia Anatomica*, terminology

1 | INTRODUCTION

Physicians and anatomists often use different terms for the same structures (Gardner, Stowell, & Dutlinger, 1947; Tubbs et al., 2005). The use of different terms, which can vary from region and discipline, might result in miscommunication, translation issues, or potentially, medical complications. One example of diverse anatomical term usage is the mandibular canal versus the inferior alveolar canal.

The mandibular canal is the pathway for the inferior alveolar neurovascular bundles in the mandible. It has the mandibular foramen and mental foramen as entrance and exit, respectively (Stranding, 2015). “Mandibular canal” has long been the accepted anatomical term for this bony canal. However, many dentists and anatomists realize that the “inferior alveolar canal” (or even the “inferior alveolar nerve canal”) is also a well-known term for this canal and is accepted in many scientific journals (Mortazavi et al., 2019; Sánchez-Torres, Soler-Capdevila,

Ustrell-Barral, & Gay-Escoda, 2019). Thus, the terminology for this bony canal is often confusing. In general, a bony canal is named after the neurovascular bundle that passes through it, for example, the infraorbital and obturator foramina, and hypoglossal canals. The “mandibular canal” is a clear exception to this rule, so some believe it should be termed the “inferior alveolar canal” consistent with other bony canals. Notably, the Federative International Program for Anatomical Terminology (FIPAT), which prescribes international anatomical terminology, recently decided to use “inferior alveolar foramen” tentatively instead of “mandibular foramen” with the logic “there are other foramina in the mandible” in *Terminologia Anatomica second edition* published in 2019 (Figure 1) (FIPAT, 2019). Therefore, we believed now was a good time to align the term of the foramen with the term used for the canal. However, the “mandibular canal” is still the term of choice for this bony canal such that the following description is used: the inferior alveolar foramen is the entrance of the mandibular canal, through which the inferior neurovascular bundles pass (FIPAT, 2019). Such a description could lead to potential misunderstanding and, thus, should be simplified. Therefore, the goal of this study was to investigate how these terms are used and understood in different regions and areas of expertise and to discuss the appropriate future application of the term “mandibular canal.”

2 | MATERIALS AND METHODS

2.1 | Screening

A literature search was conducted using PubMed on February 10, 2020. The following search words were used: “inferior alveolar canal” OR “inferior alveolar nerve canal” and “inferior alveolar canal” OR “inferior alveolar nerve canal” OR “mandibular canal.” These searches resulted in 277 and 1,223 articles, respectively. From the latest article in the list on PubMed, the Title, Abstract, Manuscript, Figure, and Figure Legends were reviewed. Terms in the Keywords and References were not reviewed.

2.2 | “inferior alveolar canal” OR “inferior alveolar nerve canal” (277 article hits)

Commentaries and letters to the editor were excluded first.

The most recent, consecutive 50 articles containing “inferior alveolar canal” or “inferior alveolar nerve canal” were included (defined as the IAC/IANC group) (Adibi, Shahidi, Nikanjam, Paknahad, & Ranjbar, 2017; Afsa & Rahmati, 2017; Al-Ekrish et al., 2018; Al-Ekrish et al., 2020; Ali, Mosleh, & Shawky, 2018; Aljarbou, Aldosimani, Althumairy, Alhezam, & Aldawsari, 2019; Arbel et al., 2019; Atef & Mounir, 2018; Česaitienė, Česaitis, Junevičius, & Venskutonis, 2017; Y. Chen, Liu, Pei, Liu, & Pan, 2018; Clark, Barbu, Lorean, Mijiritsky, & Levin, 2017; Demirel & Akbulut, 2020; Dutra et al., 2019; Elkhateeb & Awad, 2018; Ghai & Choudhury, 2018; Goller Bulut & Köse, 2018; Gumusok, Alkurt, Museyibov, & Ucok, 2016; He, Wang, Hu, & Liu, 2019; Ishii, Abe, Moro, Yokomizo, & Kobayashi, 2017; Kablan, Abu-Sobeh, Lorean, & Levin, 2020; Khojastepour, Khaghaninejad, Hasanshahi, Forghani, & Ahrari, 2019; Kubota, Imai, Nakazawa, & Uzawa, 2020; S. Lee, Lee, Kim, & Nam, 2019; Liu, Sidell, Huon, & Torre, 2018; Luangchana, Pornprasertsuk-Damrongsri, Kitisubkanchana, & Wongchuensoontorn, 2019; Mortazavi, Baharvand, & Rezaeifar, 2018; Mortazavi, Baharvand, Safi, & Behnaz, 2019; Mortazavi, Baharvand, Safi, Dalaie, et al., 2019; Patil, Pai, Vineetha, Rajagopal, & Dkhar, 2019; Patrick, Birur, Gurushanth, Raghavan, & Gurudath, 2017; Pour, Sedaghati, & Shamshiri, 2020; Prakash et al., 2018; Qi et al., 2019; Rytönen & Ventä, 2018; Saha, Kedarnath, & Singh, 2019; Şahin, Odabaşı, Demiralp, Kurşun-Çakmak, & Aliyev, 2019; Sharifi, Beshkar, Mobayeni, & Hasheminasab, 2018; Shokry et al., 2019; Sirin, Yildirimturk, Horasan, & Guven, 2020; Tabrizi et al., 2019; Tachinami, Tomihara, Fujiwara, Nakamori, & Noguchi, 2017; Tudtiam et al., 2019; Uchida, Motoyoshi, Namura, & Shimizu, 2017; Uzun, Sumer, & Sumer, 2019; Vidya, Pathi, Rout, Sethi, & Sangamesh, 2019; Wang et al., 2018; Xie et al., 2019; Yong, Lum, Makmur, Seet, & Lim, 2019; Zahedi, Mostafavi, & Lotfirikan, 2018; Zirk et al., 2019).

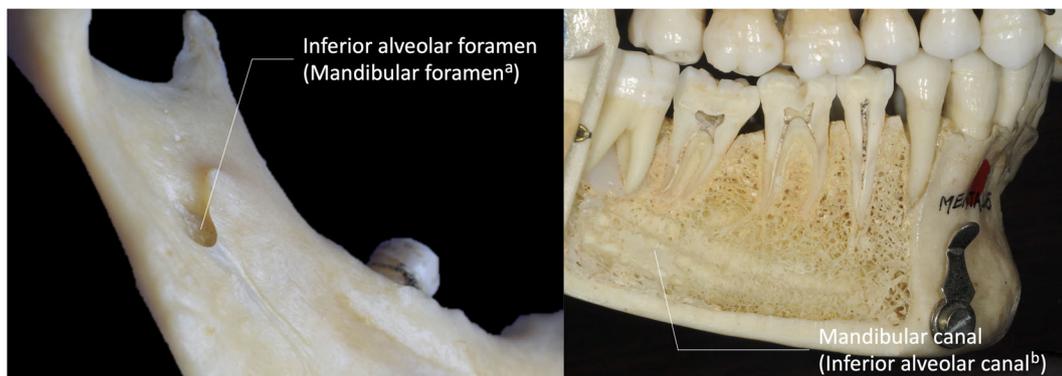


FIGURE 1 Mandible with labeling according to current terminology in *Terminologia Anatomica* second ed. ^aAccording to TA second ed., the mandibular foramen is tentatively categorized as a synonym of the inferior alveolar foramen. ^bAccording to TA second ed., the inferior alveolar canal is tentatively categorized as a synonym of the mandibular canal [Color figure can be viewed at wileyonlinelibrary.com]

2.3 | “inferior alveolar canal” OR “inferior alveolar nerve canal” OR “mandibular canal” (1,223 article hits)

Commentaries and letters to the editor were excluded first.

The articles that were included in the IAC/IANC group were excluded from this group. The most recent, consecutive 50 articles containing “mandibular canal” but neither “inferior alveolar canal” nor “inferior alveolar nerve canal” were included (defined as the MC group) (Abd Fattah, Hariri, Nambiar, Abu Bakar, & Abdul Rahman, 2019; Al-Shayyab, Qabba'ah, Alsoleihat, & Baqain, 2019; Alves, Dias, Mansa, & Machado, 2020; Arias et al., 2019; Bosykh, Turkina, Franco, Franco, & Makeeva, 2019; Bozkurt & Görürgöz, 2019; Burian et al., 2019; Cârstocea, Săndulescu, Hostiu, & Rusu, 2020; M. H. Chen et al., 2019; Costa et al., 2019; Esposito et al., 2019; Felice et al., 2019; Felice, Barausse, Pistilli, Ippolito, & Esposito, 2019; Fistarol, De Stavola, Fincato, & Bressan, 2019; Freire, Nascimento, Vasconcelos, Freitas, & Haiter-Neto, 2019; Friedrich, Matschke, & Wilczak, 2019; Iwanaga et al., 2020, 2020; Iwanaga, Wong, Kikuta, & Tubbs, 2019; Kalabalik & Aytuğar, 2019; Koç, Eroğlu, & Bilgili, 2019; Komal, Bedi, Wadhvani, Aurora, & Chauhan, 2020; K. C. Lee, Yoon, Philipone, & Peters, 2019; Liye et al., 2019; Matsuda, Yoshimura, & Sano, 2019; Matzen, Petersen, Schropp, & Wenzel, 2019; Matzen, Villefrance, Nørholt, Bak, & Wenzel, 2020; Munhoz, Arita, Nishimura, & Watanabe, 2019; Na et al., 2019; Ngeow & Chai, 2020a, 2020b; Nicol, Loncle, Pasquet, & Vacher, 2019; Okumuş & Dumlu, 2019; Oliveira et al., 2019; Ozdede, 2020; Pedersen, Matzen, Hermann, & Nørholt, 2019; Predoiu, Rusu, & Chiriță, 2019; Pucito, Lipski, Sroczyk-Jaszczyńska, Pucito, & Nowicka, 2020; Raju et al., 2019; Sahl, Alqahtani, Alqahtani, & Gallez, 2018; Satir, 2019; Sholapurkar & Davies, 2019; Sinha et al., 2019; Sun et al., 2019; Tereshchuk & Sukharev, 2019; Uğur Aydın & Göller Bulut, 2019; Valdec et al., 2019; Vranckx et al., 2019; Yalcin & Akyol, 2020; Yalcin & Artas, 2020).

2.3.1 | IAC/IANC group and MC group reviewed

The full text for both groups (100 articles) was reviewed again to confirm that the IAC/IANC group included the papers that used the term “inferior alveolar canal” and/or “inferior alveolar nerve canal” (either with or without mandibular canal), and the MC group included papers that used the term “mandibular canal” but neither “inferior alveolar canal” nor “inferior alveolar nerve canal” (Figure 2).

2.4 | Data collection

Publication year, journal title, country of the first author, and affiliations of all authors were recorded in both groups for all 100 articles.

Statistical analysis was made comparing the two groups using Student *t* tests with $p < .05$ considered significant.

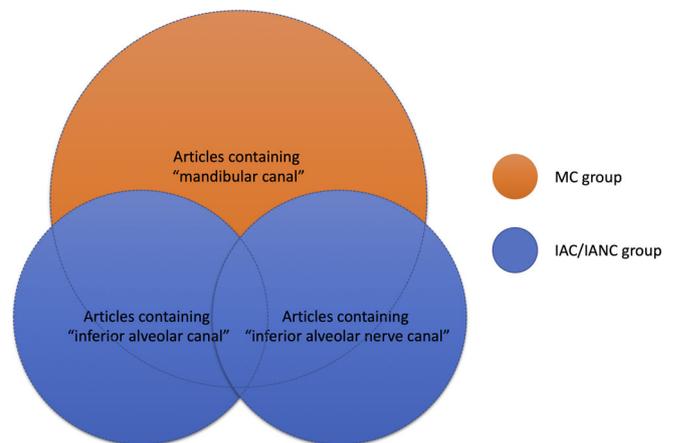


FIGURE 2 Inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group and mandibular canal (MC) group [Color figure can be viewed at wileyonlinelibrary.com]

3 | RESULTS

3.1 | Publication year

The IAC/IANC group included six articles in 2020, 21 in 2019, 14 in 2018, eight in 2017, and one in 2016. The MC group included 12 articles in 2020, 37 in 2019, and one in 2018 (Figure 3).

3.2 | Journal

Journals were classified into three groups: Anatomy journals, Dental journals, and other journals.

“Anatomy journals” included any journals that focus on anatomy and morphology. “Dental journal” included any journals with at least one of the following in the title; oral, dent, maxillofacial, craniofacial, periodont, odont, endod, or quintessence. The journals that were not included in either of the above were categorized as “other journals.” The distribution of the journals is shown in Figure 4.

There was a statistically significant difference between the IAC/IANC and MC groups in the numbers of anatomy journals and other journals in which they were included ($p < .05$).

3.3 | Country

Turkey was the country that published most frequently with 15 articles out of the total 100, followed by Iran with 10 articles, and China/India/United States with seven articles each (Figure 5).

Iran, Turkey, and China were the countries that used the term “inferior alveolar canal” or “inferior alveolar nerve canal” most frequently. Turkey, the United States, and Brazil were the countries that used the term “mandibular canal” most frequently (Figure 6).

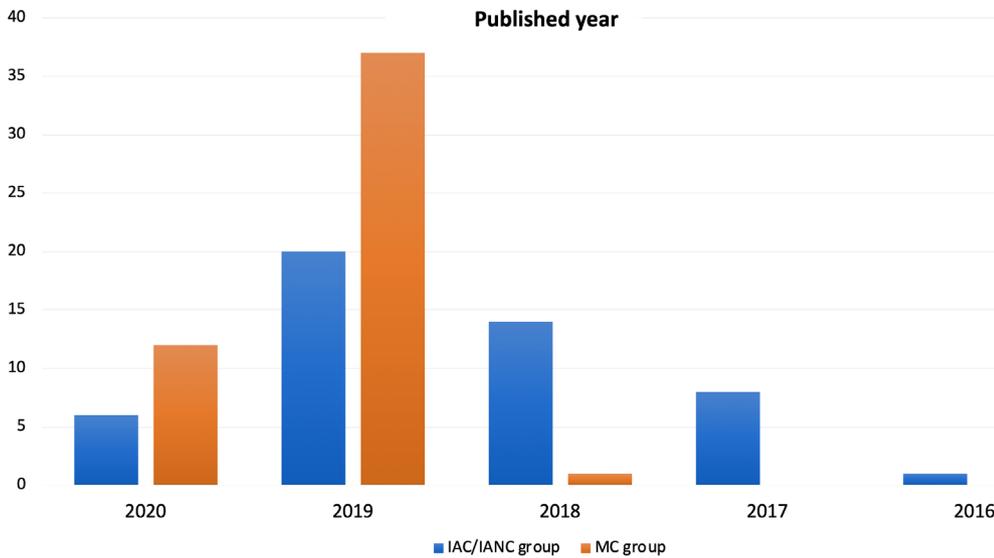


FIGURE 3 Difference between inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group and mandibular canal (MC) group for the published year [Color figure can be viewed at wileyonlinelibrary.com]

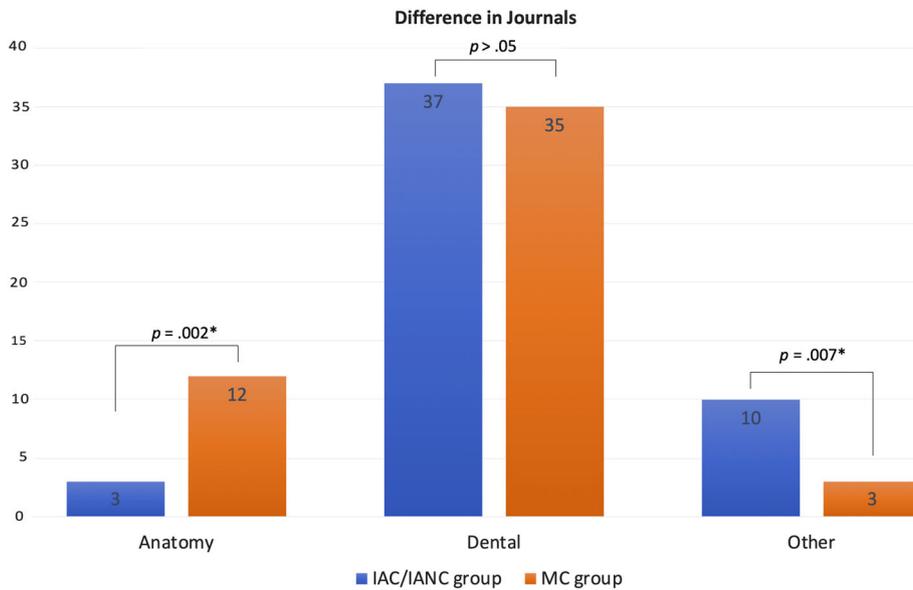


FIGURE 4 Difference between inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group and mandibular canal (MC) group for three journal types [Color figure can be viewed at wileyonlinelibrary.com]

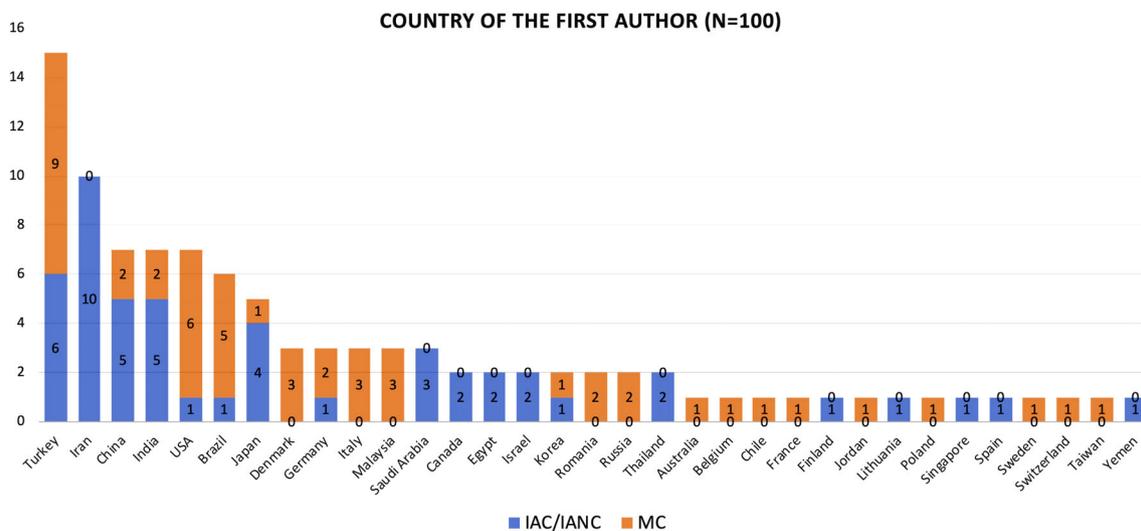


FIGURE 5 Country of the first author including both inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group and mandibular canal (MC) group [Color figure can be viewed at wileyonlinelibrary.com]

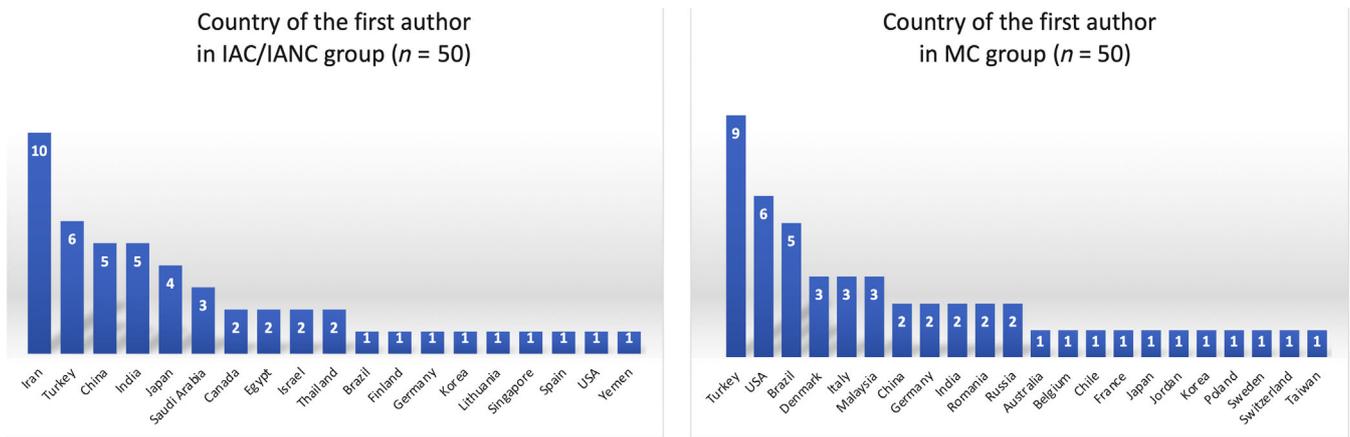
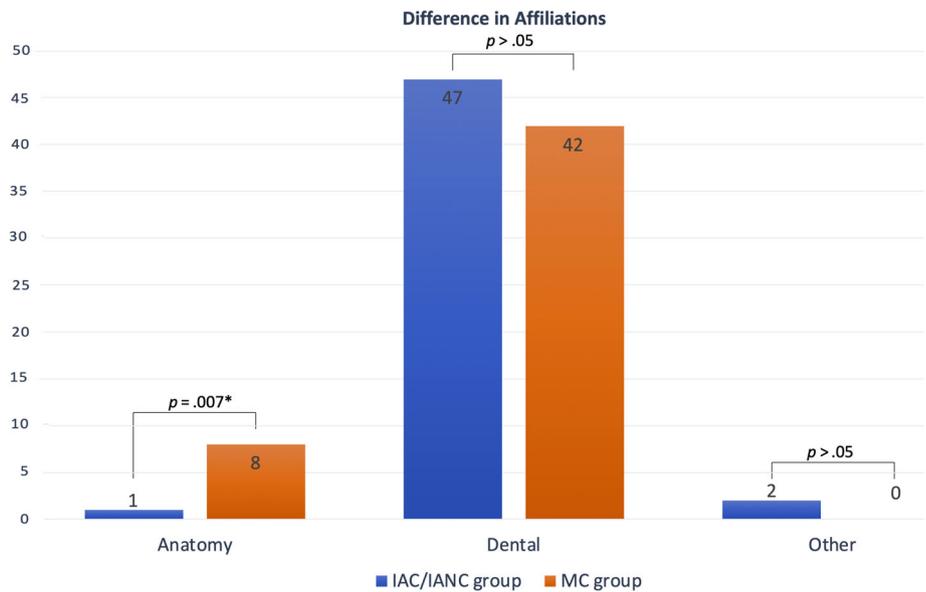


FIGURE 6 Country of the first author in the inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group (left) and mandibular canal (MC) group (right) [Color figure can be viewed at wileyonlinelibrary.com]

FIGURE 7 Difference between inferior alveolar canal/inferior alveolar nerve canal (IAC/IANC) group and mandibular canal (MC) group for three affiliation types [Color figure can be viewed at wileyonlinelibrary.com]



When the countries of the first author that had three or more publications in each group were compared, only Turkey appeared in both groups; otherwise, the two groups were occupied by different countries.

There was a statistically significant difference in the number of anatomy affiliations between the IAC/IANC and MC groups ($p < .05$).

3.4 | Affiliation

4 | DISCUSSION

Three categories of affiliation were distinguished: Anatomy, Dental, and others.

Anatomy has a long history with occasional changes in terminology. Terms for the mandibular canal are no exception and have changed many times over the years, for example, inferior alveolar canal (IAC), the inferior alveolar nerve canal (IANC), alveolar canal, dental canal, and the inferior dental canal (Mortazavi, Baharvand, Safi, Dalaie, et al., 2019; Schäfer & Thane, 1890; Standing, 2015).

Any article with anatomy or biology in the title or the affiliation of any co-authors was classified as an “anatomy affiliation.” Any that included oral, dent, maxillofacial, craniofacial, periodont, ortho, odont, or endod were categorized as a “dental affiliation.” If none of the above was included, the category applied was “other affiliation.”

In general, anatomists are more familiar with TA and usually use this terminology more strictly than dentists or others. Therefore, anatomists prefer to use the “mandibular canal” as this is the term in TA. This probably explains the significant difference between the

The distribution of the affiliations is shown in Figure 7.

IAC/IANC and MC groups in anatomy journals. There was also a significant difference between the groups in the number of “other journals,” which included non-anatomy and non-dental journals. In other words, the editors/reviewers and readers of “other journals” might be less familiar with the terminology in TA or use it less strictly than those of “anatomy journals.”

Countries of the first author that had five or more publications were: Turkey (15), Iran (10), China (seven), India (seven), United States (seven), Brazil (six), and Japan (five). Among these, interestingly, no articles from Iran were categorized in the MC group; all 10 were in the IAC/IANC group. Also, most of the publications from China, India, and Japan were in the IAC/IANC group. When the countries of the first author that had three or more publications in each group were compared (Figure 6), only Turkey appeared in both groups; otherwise, the two groups were occupied by different countries. This implies a tendency to use only one of the two terms in those countries. However, this does not determine, which country uses the “right” term for the mandibular canal.

The affiliations of the authors also affected the results. There was a significant difference between the IAC/IANC and MC groups in the number of publications with an anatomy (or anatomy-related) affiliation. This could be interpreted as mentioned earlier: those with an anatomy affiliation, who are supposed to be more familiar with TA and are likely to use the terminology more strictly, are more likely to be anatomists than those with a dental affiliation.

As shown earlier, 277 and 1,223 articles in PubMed appeared in the “inferior alveolar canal” or “inferior alveolar nerve canal” and “inferior alveolar canal” or “inferior alveolar nerve canal” or “mandibular canal” searches, respectively. The number “277” is not small and should not be ignored. Both anatomists and dentists sometimes say “inferior alveolar canal is a wrong term” and refer to the TA as evidence, but they do not explore the matter. We believe that “the inferior alveolar canal” should not be considered a wrong term. It is probably used because of human nature/habit/comfort as the structure it denotes contains the inferior alveolar neurovascular bundles.

Our study shows the results of a small sampling ($n = 100$) from a potentially large pool of articles. If we continue to avoid addressing this difference in terminologies, the choice of term selection could become more polarized, that is, mandibular canal and inferior alveolar canal, in the near future depending on expertise or country.

5 | CONCLUSION

Based on this analysis and considering that the new tentative term “inferior alveolar foramen” is used in the latest TA, we suggest mandibular canal be renamed as the “inferior alveolar canal.”

6 | LIMITATIONS

There are limitations to this study. The data included were based only on a PubMed search. Some journals are not in PubMed, which could have affected the data analysis. As seen in the publication year data,

the MC group had no articles published in either 2017 or 2016 and only one in 2018, due to the limited number of articles included. In 2020, the number is still increasing because the data search was conducted in February. Therefore, we might be able to compare the numbers of publications between the two groups only in 2019 (21 articles in the IAC/IANC group vs. 37 in the MC group). There could be differences between radiology affiliations and other clinical affiliations, but we could not differentiate them because of complexities in the names of departments and the existence of multiple authors in the same articles. Some countries have unique medical terms in their language, and sometimes the meanings of these terms differ from those in English. Therefore, if they were directly translated into English, the authors' intended meaning could be lost.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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