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Original Article

Assessment of the Root Canal Configuration of Mandibular Anterior Teeth in Turkish Population; A Systematic Review and Meta-analysis

Fatma Pertek Hatipoğlu [a], Güldane Mağat [b]

[a] Department of Endodontics, Nigde Omer Halisdemir University, Nigde, Turkey

[b] Department of Oral Radiology, Faculty of Dentistry, Necmettin Erbakan University, Konya, Turkey

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CORRESPONDENCE

Fatma Pertek Hatipoğlu
Department of Endodontics, Nigde Omer Halisdemir University, Nigde, Turkey
E-mail: pertekk_165@hotmail.com

CLINICAL SIGNIFICANCE

There is a common misconception among dentists that mandibular anterior teeth have a single root and canal. However, this meta-analysis indicates that nearly one-third of mandibular incisors and one-tenth of mandibular canines have a complex canal

ABSTRACT

Objectives: This study aims to combine the findings of various research works that leveraged cone-beam computed tomography to investigate the root morphologies of mandibular anterior teeth (MDA) in the Turkish populace.

Materials and Methods: The researchers adhered to the PRISMA guidelines while conducting this meta-analysis. Information was extracted from each study, including publication details, sample characteristics, tooth-related factors, methodological factors, and quantitative/qualitative results. The Joanna Briggs guidelines scoring system was employed to determine the risk of bias. The prevalence and Odds Ratio (OR) were analyzed using RevMan 5.3, and forest plots were generated.

Results: 10 studies met the eligibility criteria and were included in the analysis. The overall prevalence of Vertucci I in mandibular central (MDS) and lateral (MDL) was 66%, and for Mandibular canines (MDC), it was 88%. The prevalence of Vertucci III in MDS, MDL, and MDC were 20%, 19%, and 6%. The prevalence of teeth with type II, type IV, and type V Vertucci classifications was found to be less than 9% for MDA. Vertucci I prevalences did not exhibit a significant difference between genders (OR=1.31, 95%CI:0.94, 1.82; p=0.11) or between left and right arches (OR=0.96, 95%CI: 0.84,1.10; p=0.59).

Conclusion: The common notion that MDAs have a single root and canal is not entirely accurate. Nearly one-third of mandibular incisors and one-tenth of MDC display a varied canal configuration. These observations highlight the importance of clinicians being mindful of the prevalence of multiple canal configurations.

1. Introduction

One of the most important factors that can affect the outcome of endodontic treatments is the level of expertise of the treating dentist in identifying and understanding the root canal morphology.[1] The complexity of the root canal system can vary widely among individuals, and even among teeth in the same individual. Inadequate knowledge of the root canal morphology is one of the primary reasons for the failure of endodontic treatments.[2] This can lead to incomplete removal of infected or inflamed tissue, incomplete cleaning and shaping of the canal, and failure to identify and treat accessory canals that may be present. As a result, patients may experience persistent pain, infection, and inflammation, and may require further treatment or even tooth extraction.

The root canal systems of mandibular central (MDS) and lateral (MDL) incisors have a similar shape, with an oval coronal shape that gradually narrows in the middle root.[3] Although mandibular incisors (MDI) usually have a single root, there may be instances where a dentin bridge divides the root into two canals, leading to variations.[3,4] Mandibular canines (MDC) also have a wider root in the bucco-lingual direction and contain a root canal that conforms to this shape, but they rarely have multiple roots or canals.[3,4] Root canal morphology varies among different ethnic populations due to racial and genetic transmission.[5] It was previously believed that mandibular anterior teeth (MDA) typically had a single root and canal [5,6], but recent studies have shown a high probability of two canals in these teeth.[5-9]

Various methods are used in the literature to examine the root canal morphology, including staining, sectioning, and radiographic examinations on extracted teeth.[10-13] However, most of these methods are invasive and can only be applied to extracted teeth. Although periapical radiographs are routinely used in the clinic to evaluate the root canal anatomy, they provide a two-dimensional image and superpositions that make it difficult to determine variations that may exist in the root canals, such as the presence of a second and lateral canal.[14] On the other hand, cone-beam computed tomography (CBCT) systems provide images with high spatial resolution, less radiation dose, and less time compared to computed tomography.[15] For this reason, CBCT has been frequently used in dentistry in recent years for three-dimensional imaging of teeth and maxillofacial region, particularly in endodontics for detailed examinations of the root canal system.

Several studies have been conducted to investigate the root canal morphology of MDA in the Turkish population. However, studies on the Turkish population have reported inconsistent rates of Vertucci 1 configuration, ranging from 41% [16] to 97% [17], in MDA. These discrepancies necessitate a systematic review of the study results and the application of meta-analytical methods to determine the overall prevalence of these configurations and identify the underlying factors contributing to such heterogeneity. To date, no meta-analysis has been carried out for the Turkish population. Therefore, the primary objective of this study is to synthesize the findings of studies that have employed CBCT to examine the root canal morphologies of MDA in the Turkish population.

2. Materials and Methods

2.1. Guidance and Eligibility criteria

In the conduct of this meta-analysis, the researchers have ensured adherence to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[18] The inclusion criteria for this study were as follows:

1. The study must have evaluated the prevalence of root canal configuration of any MDA in the Turkish population.
2. CBCT or a more sophisticated imaging method must have been employed for the study.
3. The cross-sectional design of the study was another significant criterion for inclusion.
On the other hand, the exclusion criteria for this meta-analysis were as follows:
1. Studies that evaluated a different population were excluded.
2. Any study that employed an imaging or examination method lower than CBCT was excluded from the study.
3. Short communication, review, case report, or case series studies were also excluded from the systematic review.

2.2. Information sources and search strategy

In December of 2023, a researcher (F.P.H) conducted a search of various electronic databases, including PubMed, Web of Science, and Scopus. To carry out this search, a combination of free-text terms such as "root canal anatomy," "root canal morphology," "root canal configuration," "mandibular" were utilized. A detailed queries that were used in the information sources can be found in Table 1. In addition, to ensure comprehensive coverage, other researcher (G.M) carefully reviewed the reference lists of all relevant papers gathered during the search process. This was done in order to identify any additional studies that could be considered relevant to the research question.

2.3. Study selection and data collection process

To ensure that our study was comprehensive and accurate, we utilized a reference management software, namely EndNote® X9 Thomson Reuters from Philadelphia, PA, USA. Using this software, we carefully screened and removed any duplicate studies that could skew our results. The final selection of candidate studies was then agreed upon by our team of researchers, which included individuals with extensive experience in the field.

We extracted the following information from each study to ensure that we gathered all the necessary information: (1) publication details, including the journal, title, authors, date, country, and city where the study was conducted, (2) sample characteristics, such as sample size, age, and gender of the participants, (3) tooth-related factors, including the examined tooth group, (4) methodological factors, such as the CBCT brand used, voxel size, and root canal classification, and (5) qualitative and quantitative results.

2.4. Risk of bias within studies

In order to evaluate the risk of bias in individual studies, two analysts (F.P.H, G.M.) utilized the Joanna Briggs Institute (JBI) critical appraisal tool for prevalence studies.[19] The assessment was conducted independently by each analyst and a mutual agreement was then reached. The Joanna Briggs guidelines scoring system and cutoff points were employed to determine the risk of bias. Studies which scored below 49% were classified as having a "high risk of bias," while those scoring between 50 to 69% were regarded as having a "moderate risk of bias." Studies scoring over 70% were considered to have a "low risk of bias."adhered to for scoring and established cutoff points to classify studies into different risk of bias categories. Studies with up to 49% of questions scored as "yes" were deemed to have a high risk of bias, those with scores ranging from 50 to 69% as moderate risk, while those with more than 70% as low risk.

2.5. Summary Measures

The primary outcomes in this study were the Vertucci classification prevalences according to tooth type. To compare the genders and left-right arches (Only Vertucci I variables were based), the Odds Ratio (OR) and its respective 95% confidence intervals (95% CI) were utilized as the primary outcome was dichotomous.

Table 1. Queries that were used in information sources

Database	Search strategy
PubMed	(((root canal anatomy[Title]) OR (root canal morphology[Title]) OR (root canal configuration[Title])) AND ((mandibular[Title]))))
Web of Science	TI=((root canal anatomy OR root canal morphology OR root canal configuration) AND (mandibular))
Scopus	TITLE(root canal anatomy) OR TITLE(root canal morphology) OR TITLE(root canal configuration) AND TITLE(mandibular)

2.6. Synthesis of results

The standard error of prevalence was determined using the formula $\sqrt{(p(1-p)/n)}$, where p represents the observed prevalence and n denotes the sample size. This calculation was executed via an Excel sheet.[20] To estimate the association between left-right teeth and gender, we employed OR and a 95% CI. The overall prevalence and OR were evaluated using the meta-analysis software, RevMan 5.3 (The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark), and forest plots were generated. We determined the statistical heterogeneity among studies using the Higgins I^2 test and categorized it as not significant (<30%), moderate (30%–50%), substantial (50%–75%), or considerable (75%–100%).[21] As we could not achieve methodological, clinical, and statistical homogeneity together, we preferred a random-effects model with 95% CI as the meta-analysis model. We set the level of significance at $p < 0.05$.

2.7. Risk of Bias Across Studies

In order to assess whether there is a publication bias in the data, the researchers examined the funnel plots visually.

3. Results

3.1. Study Selection

The current study involved a systematic search of various academic databases, including Pubmed, Web of Science, Scopus, as well as reference lists of relevant papers. The search strategy yielded a total of 707 records, which were subsequently screened for duplicates, resulting in a final pool of 376 studies. Upon further scrutiny, only 10 studies [16,17,22-29] were found to meet the eligibility criteria and were thus included in both qualitative and quantitative syntheses. A graphical representation of the included studies is provided in Supplemental File 1.

3.2. Characteristics of the included studies

The present meta-analysis included a series of journal articles, with the earliest one dating back to 2014 [22] and the latest to 2023 [29]. Izmir city [22-24] emerged as the most commonly studied area, with a total of three research articles, whereas the city of Van [28] was investigated in only one study. It is worth noting that, although the Vertucci classification was employed across all studies, three of them [17,23,24] opted for alternative classification systems, namely Ng's and Sert Bayırlı's classifications. Table 2 contains the characteristics of the studies that were included.

3.3. Risk of bias within the studies

Upon conducting the analysis of ten studies, it was found that half of the studies displayed a low risk of bias [22,24,25,27,28], while the remaining half exhibited a moderate level of bias [16,17,23,26,29] (Table 3).

3.4. Synthesis of results

In the MDA teeth, the prevalence of Vertucci I, II, III, IV, and V

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Table 2. Characteristics of the studies included in the qualitative synthesis (n=10)

Study	Publication type	Year	City	Age range	Examined Tooth Group	Sample Size	Imaging technique	Classification
Altunsoy, et al. [22]	Journal article	2014	İzmir	14-70 years	Mandibular/Maxillar central, lateral, canin	MDS: 1582 MDL: 1603 MDC: 1604	I-CAT Vision TM Imaging Science Voxel size: 0.3 mm	Vertucci's classification
Arslan, et al. [23]	Journal article	2015	İzmir	10-70 years	Mandibular central, lateral	MDS:96 MDL:100	NewTom 5G CBCT machine (QR Srl, Verona, Italy) Voxel size: 0.15 mm	Vertucci's classification, Ng's classification
Orhan, et al. [16]	Journal article	2018	Ankara	18-86 years	Mandibular central, lateral, canin	MDS: 261 MDL: 275 MDC: 266	3D Accuitomo 180 (Morita, Japan) Voxel size: 0.08-0.25 mm	Vertucci's classification
Karataslioglu, et al. [24]	Journal article	2019	İzmir	15-60 years	Mandibular/Maxillar canin	MDC: 419	NewTom 5G CBCT machine (QR Srl, Verona, Italy) Voxel size: 0.15 mm	Vertucci's classification, Sert Bayırlı's classification, Ng's classification
Mağat [25]	Journal article	2019	Konya	14-75 years	Mandibular/Maxillar canin	MDC: 820	3D Accuitomo 180 (Morita, Japan) Voxel size: -	Vertucci's classification
Özsoy, et al. [26]	Journal article	2019	Konya	15-52 years	Mandibular central, lateral	MDS: 118 MDL: 119	* Kavo (Examvision, Dental Excellence Version 1.8.1.10, Biberach, Germany), * Planmeca (Promax 3Bs / 3B, Helsinki, Finland), * Instrumentarıum (Ortopantomograph OP300, Tuusula, Finland), * Kodak (9000/3D sistemi Carestream Health Inc, Rochester NY, U.S.A) * Morita (3D Accuitoma 170, Morita, Tokyo, Japan)	Vertucci's classification
Erkan, et al. [27]	Journal article	2020	Istanbul	13-79 years	Mandibular central, lateral, canin	MDS: 939 MDL: 947 MDC: 937	ani-CAT17–19 Imaging System (Imaging Sciences Int., Inc.) Voxel size: 0.25 mm	Vertucci's classification
Gündüz, et al. [28]	Journal article	2021	Van	-	Mandibular/Maxillar canin	MDC: 1002	Orthophos XG Plus (Sirona, Bensheim, Germany) Voxel size: 0.75 mm	Vertucci's classification
Eren, et al. [17]	Journal article	2022	Ankara	18-** years	Mandibular/Maxillar central, lateral, canin, premolar, molar	MDS: 400 MDL: 400 MDC: 399	Planmeca (Promax 3Bs / 3B, Helsinki, Finland) Voxel size: 0.20 mm	Vertucci's classification, Sert Bayırlı's classification
Okumus, et al. [29]	Journal article	2023	Istanbul	14-76 years	Mandibular/Maxillar canin	MDC: 235	NewTom VGi evo (CeflaGroup, Verona, Italy) Voxel size: 0.30 mm	Vertucci's classification

MDS: Mandibular central incisor, MDL: Mandibular lateral incisors, MDC: Mandibular canines

Table 3. Risk of bias summary, assessed by Joanna Briggs Institute Critical Appraisal Checklist for prevalence studies (n=10): author's judgments for each included study

Author	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total	Risk of Bias
Altunsoy, et al. [22]	Y	NA	Y	Y	Y	NA	Y	Y	NA	100%	Low
Arslan, et al. [23]	Y	NA	N	Y	N	NA	N	Y	NA	50%	Moderate
Orhan, et al. [16]	Y	NA	N	Y	N	NA	N	Y	NA	50%	Moderate
Karatasliogl u, et al. [24]	Y	NA	Y	Y	N	NA	Y	Y	NA	83%	Low
Mağat [25]	Y	NA	Y	Y	Y	NA	Y	Y	NA	100%	Low
Özsoy, et al. [26]	Y	NA	N	Y	N	NA	Y	N	NA	50%	Moderate
Erkan, et al. [27]	Y	NA	Y	Y	Y	NA	N	Y	NA	83%	Low
Gündüz, et al. [28]	Y	NA	Y	N	Y	NA	Y	Y	NA	83%	Low
Eren, et al. [17]	Y	NA	Y	N	N	NA	Y	Y	NA	67%	Moderate
Okumus, et al. [29]	Y	NA	N	Y	N	NA	U	Y	NA	50%	Moderate

Legend: Y= Yes; N= No; U= Unclear, NA= Not applicable; Prevalence Study Checklist: Q1- Was the sample frame appropriate to address the target population? Q2- Were study participants sampled in an appropriate way? Q3- Was the sample size adequate? Q4- Were the study subjects and the setting described in detail? Q5- Was the data analysis conducted with sufficient coverage of the identified sample? Q6- Were valid methods used for the identification of the condition? Q7- Was the condition measured in a standard, reliable way for all participants? Q8- Was there appropriate statistical analysis? Q9- Was the response rate adequate, and if not, was the low response rate managed appropriately? Total= ΣY/Applicable Items. Risk of bias was categorized as high when the study reaches up to 49% score "yes", moderate when the study reached 50% to 69% score "yes", and low when the study reached more than 70% score "yes.

ranges from 41% to 97%, 0% to 36%, 1% to 42%, 0% to 5%, and 0% to 24%, respectively. Overall prevalences of Vertucci I, II, III, IV, and V were 74% (95% CI, 68%–81%), 6% (95% CI, 5%–8%), 13% (95% CI, 11%–16%), 1% (95% CI, 0%–1%), and 4% (95% CI, 1%–7%), respectively. Considerable heterogeneity (I^2>75%) was observed in all meta-analyses regarding Vertucci classification. There were significant differences between subgroups in Vertucci I and III (p<0.05), but no significant difference was found in other Vertucci classifications (p>0.05) (Fig. 1-2, Supplemental File 2).

In the subgroup analysis of MDS, the prevalence of Vertucci I, II, III, IV, and V ranges from 43% to 84%, 0% to 28%, 1% to 42%, 1% to 4%, and 0% to 10%, respectively. Overall prevalences of Vertucci I, II, III, IV, and V were 66% (95% CI, 50%–82%), 7% (95% CI, 4%–11%), 20% (95% CI, 9%–31%), 2% (95% CI, 0%–3%), and 3% (95% CI, 0%–6%), respectively. In all meta-analyses, considerable heterogenity (I^2>75%) was observed (Fig. 1-2, Supplemental File 2). heterogenity (I^2>75%) was observed (Fig. 1-2, Supplemental File 2).

In the subgroup analysis of MDL, the prevalence of Vertucci I, II, III, IV, and V ranges from 41% to 80%, 1% to 30%, 1% to 42%, 0% to 5%, and 1% to 12%, respectively. Overall prevalences of Vertucci I, II, III, IV, and V were 66% (95% CI, 54%–77%), 9% (95% CI, 5%–14%), 19% (95% CI, 8%–31%), 2% (95% CI, 0%–3%), and 4% (95% CI, -1%–9%), respectively. In all meta-analyses, considerable heterogenity (I^2>75%) was observed (Fig. 1-2, Supplemental File 2).

In the subgroup analysis of MDC, the prevalence of Vertucci I, II, III, IV, and V ranges from 48% to 97%, 0% to 36%, 1% to 13%, 1% to 2%, and 1% to 24%, respectively. Overall prevalences of Vertucci I, II, III, IV, and V were 88% (95% CI, 84%–92%), 4% (95% CI, 2%–7%), 6% (95% CI, 4%–8%), 1% (95% CI, 0%–1%), and 5% (95% CI, -1%–12%), respectively. In all meta-analyses, considerable heterogenity (I^2>75%) was observed (Fig. 1-2, Supplemental File 2).

Vertucci I prevalences did not exhibit a significant difference between genders (OR=1.31, 95% CI: 0.94, 1.82; p=0.11). In all subgroups, no significant difference was found, too (p>0.05). Considerable heterogenity (I^2>75%) was observed in the overall effect and all subgroups (Fig. 3).

Vertucci I prevalences did not exhibit a significant difference between left and right arches (OR=0.96, 95% CI: 0.84, 1.10; p=0.59). In all subgroups, no significant difference was found, too (p>0.05). No significant heterogenity (I2<30%) was observed in the overall effect and all subgroups (Fig. 3).

3.5. Risk of bias across studies

Following a visual evaluation of the funnel plot analysis, it was determined that there was no observable publication bias. The results of the analysis suggest that the data is unbiased and can be considered reliable (Supplemental File 3).

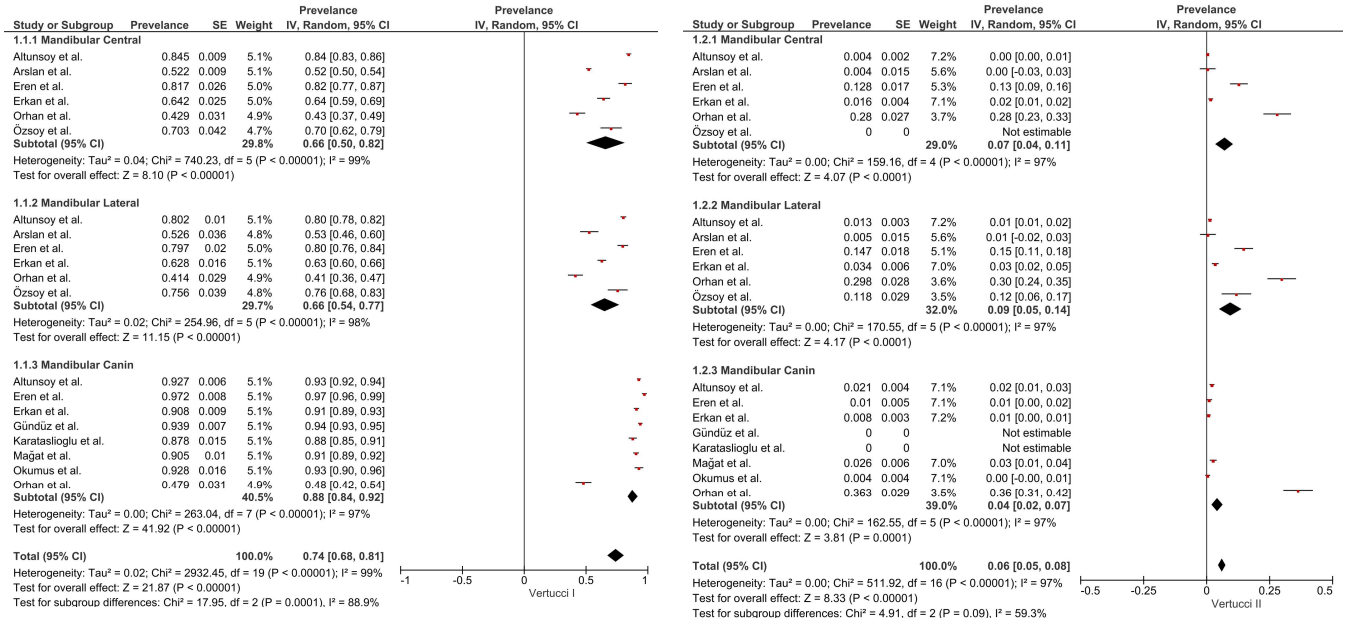

Fig. 1. Forest Plot presentation of the prevalence of Vertucci I (left) and II (right) in mandibular anterior teeth

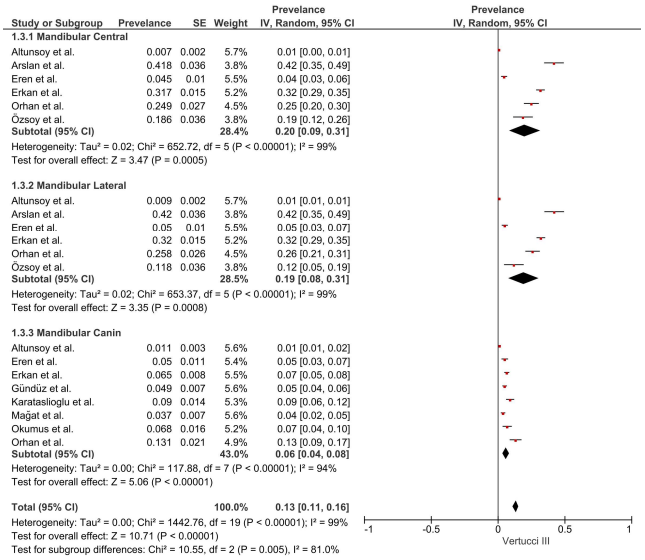

Fig. 2. Forest Plot presentation of the prevalence of Vertucci III in mandibular anterior teeth

4. Discussion

Achieving a successful endodontic treatment in clinical practice requires thorough cleaning, shaping, and filling of the entire root canal system. Failure to notice and complete treatment of an additional canal can result in treatment failure.[2] Although the majority of MDA have a single root and canal [8,30-33], clinicians should pay attention to the localization of all canals to ensure complete removal of pulp tissue and necrotic debris.[31] Any missed canal can have a direct impact on the treatment's prognosis.[32] Cross-sectional studies of root canal morphology using CBCT can be useful for certain populations with large numbers of patients.[34,35] Many studies have demonstrated the high reliability of CBCT in detecting root and root canal morphology compared to visual inspection by sectioning.[36,37] As a result of these factors, the current study included research that utilized CBCT or other advanced imaging techniques.

The prevalence of Vertucci I in MDA teeth was analyzed in several studies. The study conducted by Orhan, et al. [16] had the lowest prevalence of Vertucci I (43%, 41%, and 48% for MDS, MDL, and MDC, respectively), while the study by Altunsoy, et al. [22] had the highest prevalence of Vertucci I in MDI teeth (84% and 80% for MDS and MDL, respectively). The prevalence of Vertucci I in MDC was found to be 97% in the study conducted by Eren, et al. [17]. In this meta-analysis, the overall prevalence of Vertucci I in MDI was 66%, while that of canine teeth was 88%. The study by Usha, et al. [38], which evaluated the root canal morphology of MDA teeth in the Asian population by meta-analysis, found the prevalence of Vertucci I to be 78.4%, 69.2%, and 91.1% in MDS, MDL, and MDC, respectively.

The prevalence of Vertucci III in MDA teeth was found to be lowest in the study of Altunsoy, et al. [22] (MDA 0.01%), while the highest prevalence of Vertucci III in MDI teeth was observed in the study of Arslan, et al. [23] (MDI 42%), and in MDC teeth, it was found in the study of Orhan, et al. [16] (MDC 13%). This meta-analysis revealed that the total Vertucci III prevalence of MDA teeth was 20%, 19% and 0.06% for MDS, MDL and MDC, respectively. This outcome was consistent with several previous studies showing that the second most common root canal configuration type for MDA is Type III Vertucci.[31-33,39] In contrast to other studies, Orhan, et al. [16] found that the most common type after Type I Vertucci was type II Vertucci. Type II was the third most common type of canal morphology for Vertucci MDI teeth and the fourth most common type for MDC teeth, based on the total prevalence in this meta-analysis. Furthermore, this study found that the proportion of teeth with Type II, Type IV and Type V Vertucci morphology was less than 9% for MDA teeth.

This meta-analysis study consisted of ten studies [16,17,22-29] that examined the root canal morphology of MDA teeth in the Turkish population using CBCT. The varying results between these studies can be attributed to several factors, including disparities in sample sizes, technical differences in the CBCT devices employed (voxel size, fov, irradiation time, etc.), variances in the Turkish subpopulation, and differences in the observers who evaluated CBCT.

Several studies were conducted to determine whether there is a relationship between gender and the Vertucci root canal system type in MDA. Altunsoy, et al. [22] found a higher rate of Type I Vertucci in females for MDS and MDL, while Erkan, et al. [27] found a higher rate in males for MDL. As for canine teeth, numerous studies [16,24,27,28] found a higher rate of Type I Vertucci in males. However, when considering the total effect sizes in this study, no significant relationship was found between genders in any anterior tooth group.

In the research conducted by Lin, et al. [40], it was found that 92.7% of MDS and 89.2% of MDL showed symmetrical morphology on both the right and left sides in terms of the Vertucci's canal configuration. Similarly, in the study by Taha, et al. [6], the rate of bilateral symmetry between the right and left sides was found to be 75.42%, 67.48%, and 64.84% for MDS, MDL, and MDC, respectively. However, it should be noted that this meta-analysis

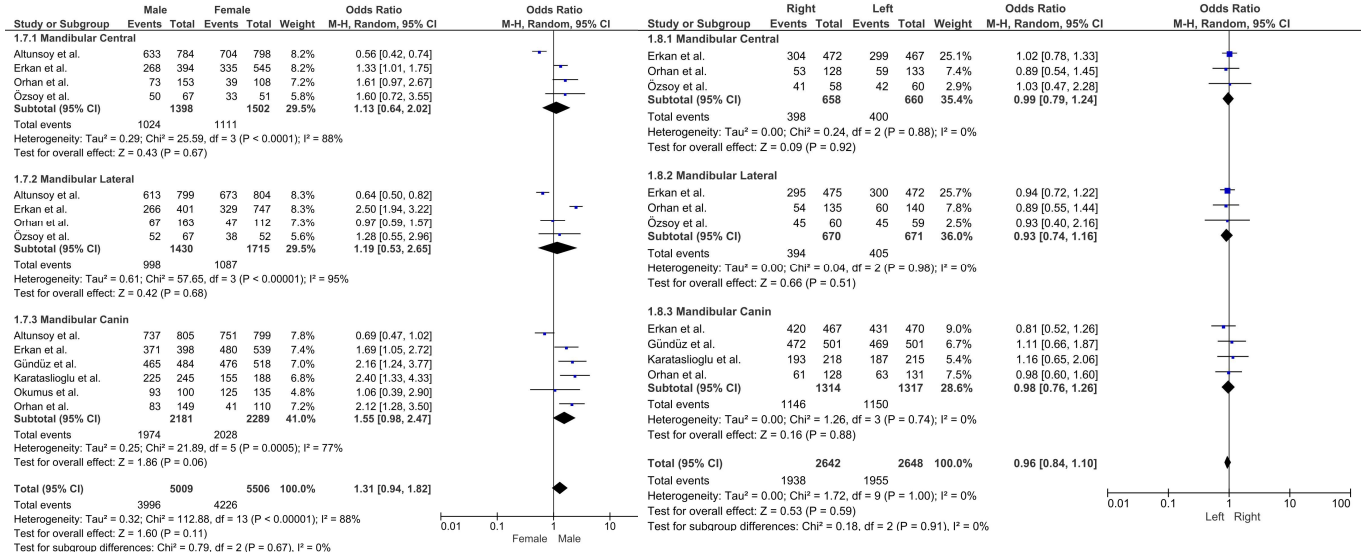

Fig. 3. Forest Plot presentation of the comparison between genders (left) and arches (right) regarding the prevalence of Vertucci I in mandibular anterior teeth

did not specify the root canal variation between the right and left teeth of the same patient, which prevented the evaluation of bilateral symmetry ratios. Nevertheless, the study found no significant difference in the Type I Vertucci ratio between the right and left MDA, indicating that the presence of a single canal in one tooth of a patient makes it likely that the symmetry tooth will also have a single canal.

It is quite common for dentists to hold the belief that MDA have only a single root and canal. However, this misconception can sometimes lead to incomplete removal of infected or inflamed tissue, as well as incomplete cleaning and shaping of the canal.[1] In addition, the failure to identify and treat accessory canals that may be present can further exacerbate the problem. This can result in patients experiencing persistent pain, infection, and inflammation, and may ultimately require more extensive treatment or even the extraction of the tooth.[2] To address this issue, this meta-analysis has revealed that nearly one-third of MDI and one-tenth of MDC exhibit a complex canal configuration in the Turkish population. Therefore, it is important for dentists to update their knowledge and understanding of the canal configurations in mandibular anterior teeth to ensure that they are providing their patients with the most effective and appropriate treatment options available.

This study has some limitations that need to be considered. The low sample size of some studies may lead to a risk of bias since rare configurations may not be detected. The reliability of the data acquired is subject to significant fluctuations based on the proficiency of the observer, leading to potential observer bias. Although some studies used multiple observers, inter-rater reliability was not determined. Heterogeneity may also arise from differences in CBCT device, voxel size, and FOV area since changing voxel sizes can increase or decrease the error in detection. Furthermore, the studies were conducted mostly in the same cities, which limits the generalizability of the results to the entire Turkish population. Publication bias was not a concern based on the funnel plot analysis; already, most of the studies were published in relatively lower-quality journals. However, the methodological quality of some studies is questionable since they do not mention the percentage of cases that cannot be classified using Vertucci.

5. Conclusion

Within the limitation of the study, the total prevalence of Vertucci I configuration in the Turkish population was found for MDI and MDC teeth at 66% and 88%, respectively. Vertucci III is the second most common root canal configuration type for MDA. No discernible variations were found between the genders or the right and left arches for Vertucci I. Contrary to the belief that MDAs generally have a single root and canal, the data reveals that almost one-third of MDI teeth, and one-tenth of MDC teeth have a complex canal configuration. These findings suggest that clinicians should be aware of the prevalence of multiple canal configurations and be cautious during root canal treatments to avoid potential complications.

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Conflict of Interest

The authors declare that no conflict of interest is available

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