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LARISSA MOREIRA DE SOUZA

CONCORDÂNCIA ENTRE RADIOLOGISTAS ODONTOLÓGICOS E CIRURGIÕES BUCO MAXILOFACIAIS E ENTRE DIFERENTES MÉTODOS DE IMAGEM NA DECISÃO DE DIAGNÓSTICO PARA CANAL MANDIBULAR BÍFIDO E FORAME MENTUAL ACESSÓRIO

AGREEMENT BETWEEN ORAL AND MAXILLOFACIAL RADIOLOGISTS AND SURGEONS AND BETWEEN DIFFERENT IMAGING METHODS IN THE DIAGNOSTIC DECISION MAKING FOR BIFID MANDIBULAR CANAL AND ADDITIONAL MENTAL FORAMEN

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Orientadora: Prof. Dra. Luciana Asprino

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RESUMO

O objetivo deste estudo foi avaliar a concordância entre profissionais de duas especialidades odontológicas, Radiologia Odontológica (RO) e Cirurgia Buco-Maxilo-Facial (CBMF), e entre diferentes métodos de imagem, radiografia panorâmica e tomografia computadorizada de feixe cônico (TCFC), na decisão de diagnóstico para canal mandibular bífido (CMB) e forame mentual acessório (FMA). A amostra foi composta por 20 especialistas (10 radiologistas odontológicos e 10 cirurgiões buco-maxilo-faciais) com mais de 2 anos de experiência. Além destes, dois avaliadores com mais de 15 anos de experiência em exames por imagem, um radiologista odontológico e um cirurgião buco-maxilo-facial foram selecionados como padrão de referência para cada especialidade. Foram avaliadas, de forma independente, 30 radiografias panorâmicas e 30 imagens de TCFC dos mesmos pacientes, as quais foram previamente selecionadas por dois pesquisadores. Inicialmente, foram avaliadas as radiografias panorâmicas e, em seguida, as imagens de TCFC, utilizando uma escala de cinco pontos (1 – Ausente; 2 – Provavelmente ausente; 3 – Incerteza; 4 – Provavelmente presente; 5 – Presente) para o diagnóstico de CMB e FMA em cada hemimandíbula. As imagens foram distribuídas de forma aleatória e sem identificação para assegurar uma avaliação cega. A análise estatística se deu através do teste de Kappa e do teste de Friedman (nível de significância de 5%). Os resultados mostraram que, para o diagnóstico de CMB, no geral, não houve concordância entre os ROs e nem entre os CBMFs, considerando as avaliações em radiografia panorâmica e TCFC. O teste de Friedman mostrou que não houve diferença estatisticamente significante entre os valores de Kappa ($p = 0.1005$) para os especialistas e nem para os diferentes métodos de imagem. No que se refere à concordância entre os padrões de referência das duas áreas, houve uma concordância leve e significativa ($p = 0.0462$), apenas quando os mesmos utilizaram TCFC. Já para o diagnóstico de FMA, no geral, não houve concordância entre os radiologistas odontológicos e entre os CMBFs. Entretanto, houve maior valor kappa quando a TCFC foi utilizada tanto para os CBMFs ($p=0.0176$) quanto para os ROs ($p=0.0446$) e ainda, os radiologistas odontológicos produziram maior valor de kappa do que os CBMFs, considerando as avaliações em TCFC ($p=0.0106$), mas não houve diferenças estatisticamente significantes quando a panorâmica ($p=0.0679$) foi empregada. Para os padrões de referência, houve concordância moderada e significante (<0.0001), apenas com relação as avaliações em TCFC. É possível concluir que o CMB e o FMA são variações anatômicas de difícil diagnóstico. No geral, não há concordância entre os especialistas da Radiologia Odontológica e CBMFs, nem mesmo entre os profissionais de mesma área, como também não há concordância entre os diagnósticos em radiografias panorâmicas e TCFC para diagnóstico de CMB. Os especialistas concordam mais entre si quando utilizam TCFC e os radiologistas odontológicos concordam mais em suas decisões de diagnóstico para FMA do que entre os CBMF, o que mostra que os radiologistas utilizam critérios de diagnóstico mais padronizados para o diagnóstico de FMA.

Palavras-chave: Procedimentos Cirúrgicos Bucais. Radiografia Panorâmica. Tomografia Computadorizada de Feixe Cônico. Variação anatômica.

ABSTRACT

The aim of this study was to evaluate the agreement between oral and maxillofacial radiologists (OMFR) and oral and maxillofacial surgeons (OMFS), and between two different imaging methods, panoramic radiography (PAN) and cone beam computed tomography (CBCT) in the diagnosis decision for bifid mandibular canal (BMC) and additional mental foramen (AMF). The sample consisted of 20 specialists (10 OMFR and 10 OMFS) with more than 2 years' experience. Other specialists with more than 15 years' experience with imaging exams, an OMFR and an OMFS were selected as senior specialist for each specialty. Two researchers selected 30 PANs, and 30 CBCT images from the same patients. All examiners from both specialties assessed the PANs and, after that, the CBCT volumes in a random order, using a five - point scale (1 – absent; 2 - probably absent; 3 – uncertainty; 4 - probably present and 5 - present) for each hemimandible, for BMC and AMF diagnosis. Statistical analysis was performed using the Cohen's Kappa and the Friedman's test (significance level 5%). For BMC diagnosis, there was no agreement between OMFR and OMFS with their correspondent senior specialists, considering the evaluations in PAN and CBCT. The Friedman's test showed no statistically significant difference between the Kappa values (p = 0.1005) for both group of specialists and for PAN and CBCT evaluations. Regarding the agreement between the senior specialists, there was a slight and significant agreement (p = 0.0462), only when they used CBCT. For AMF diagnosis, there was no agreement between OMFR and OMFS with their correspondent senior specialists. However, there was a higher kappa value when CBCT was used by both OMFS (p = 0.0176) and OMFR (p = 0.0446), comparing with PAN evaluation. Moreover, OMFR produced higher kappa values than OMFS, considering the evaluations in TCFC (p = 0.0106), but there were no statistically significant differences when PAN (p = 0.0679) was used. For the senior specialists, there was a moderate and significant agreement (<0.0001), only in relation to the CBCT assessments. In conclusion, BMC and AMF are difficult to diagnose. There is no agreement between OMFR and OMFS, nor even among professionals of the same specialty and nor between PAN and CBCT evaluations for BMC diagnosis. However, for AMF diagnosis, the both group of specialists obtain greater agreement when is used CBCT and, OMFR have more agreement among themselves than OMFS.

Key Words: Panoramic radiography; Cone Beam Computed Tomography; Oral Surgical Procedures; Anatomical variation.

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1 INTRODUÇÃO

O canal da mandíbula é um conduto intraósseo localizado no interior da mandíbula, tendo a sua origem no forame mandibular e estendendo-se até o forame mentual (KUCZYNSKI et al., 2014; CASTRO et al., 2015; HAAS et al., 2016). Localizado dentro deste canal, o nervo alveolar inferior (NAI) é um ramo da terceira divisão do nervo trigêmeo (MOTAMEDI et al., 2015). O NAI acessa o forame mandibular, percorrendo o curso do canal da mandíbula e, no forame mentual, emerge na direção vestibular, aproximadamente na altura da região dos segundos pré-molares (CLAEYS et al., 2005; GERLACH et al., 2010; MIZBAH et al., 2012; CASTRO et al., 2015). Esse canal não só contém o NAI, responsável pela sensibilidade, mas também vasos sanguíneos que fornecem nutrição para os dentes e as suas estruturas adjacentes (KIM et al., 2011; MOTAMEDI et al., 2015).

Grande parte dos canais da mandíbula percorre um único curso em cada hemimandíbula (CASTRO et al., 2015), porém, em certos casos, pode ocorrer uma ramificação onde um canal acessório surge, sendo então chamado de canal mandibular bífido (CMB) (ROUAS et al., 2007; FUKAMI et al., 2012; KANG et al., 2014). Essa variação anatômica tem sido reportada desde 1973 (KIERSH; JORDAN, 1973) e estudos sugerem que seu desenvolvimento seja resultado da fusão incompleta de três ramificações do nervo alveolar inferior, destinados a inervar três grupos diferentes de dentes (incisivos, pré-molares e molares), os quais, em um processo normal, se fusionam durante a embriogênese, formando um único NAI (CHÁVEZ-LOMELI et al., 1996).

Além do canal mandibular bífido, outra variação anatômica que pode ocorrer na mandíbula é a presença do forame mentual acessório (FMA) (IMADA et al., 2014). Os nervos e vasos que se alocam no canal da mandíbula, emergem do forame mentual e, neste caso, também saem pelo FMA (IWANAGA et al., 2016). Em geral, os forames mentuais acessórios estão localizados em áreas que requerem cautela durante os procedimentos odontológicos (IWANAGA et al., 2016), podendo aparecer distais (AHMED et al., 2015, OLIVEIRA-SANTOS et al., 2011) ou superiores (IMADA et al., 2014) ao forame mentual.

Apesar de ser clinicamente inviável, a dissecção experimental ou inspeção visual de mandíbulas secas, são descritos como os melhores métodos para detecção dessas variações anatômicas. Entretanto, segundo alguns autores, exames de imagens tornaram essa identificação possível (NEVES et al., 2015). O fato é que a existência de CMB e

FMA é frequentemente ignorada pelos cirurgiões-dentistas (AHMED et al., 2015; NEVES et al., 2015) e os livros de anatomia pouco exploram esse assunto (ROUAS et al., 2007), apesar de sua prevalência não ser rara (CLAEYS et al., 2005) e variar de 4,20% a 16,25% para CMB, em avaliações realizadas em radiografias panorâmicas e TCFC, respectivamente (HAAS et al., 2016), e de 2% a 13% para FMA (IWANAGA et al., 2016), considerando os mesmos métodos de imagem citados.

Radiograficamente, o canal mandibular bífido aparece como uma imagem radiolúcida, bem delimitada por duas linhas radiopacas (KIM et al., 2011; FUKAMI et al., 2012). Já o forame mentual acessório pode apresentar diversas conformações e, em uma radiografia, a sua visibilidade pode depender de fatores anatômicos como diâmetro, forma e ângulo em relação à incidência do feixe de raios X (MUINELO-LOREZNO et al., 2015). Por isso, não apenas a qualidade do exame, mas também o conhecimento anatômico da região é importante na avaliação da imagem radiográfica (KUCZYNSKI et al., 2014; HAAS et al.,2016).

O advento da tomografia computadorizada de feixe cônico (TCFC) trouxe vantagens com relação à radiografia panorâmica, por se tratar de um exame tridimensional e sem sobreposição de imagens (MIZBAH et al., 2012; FUKAMI et al., 2012; IMADA et al., 2014). Porém, o CMB e o FMA não são estruturas anatômicas de fácil detecção, uma vez que podem ser confundidos com trabeculado ósseo e canais nutritivos na mandíbula, respectivamente, podendo sub ou superestimar a presença destas variações anatômicas na imagem (KIM et al., 2011; HAAS et al., 2016).

Conhecer a anatomia do canal da mandíbula em toda a sua extensão, bem como sua localização e configuração é de suma importância quando procedimentos odontológicos, principalmente cirurgias, envolvem a mandíbula (FUKAMI et al., 2012; CASTRO et al., 2015), visto que a não detecção dessas variações anatômicas pode levar a complicações potenciais como, parestesia do nervo alveolar inferior, neuroma traumático, sangramento, hematomas e falhas na eficácia anestésica (KAUFMAN et al., 2000; CLAEYS et al., 2005).

De acordo com a literatura, cirurgiões-dentistas reconheceram a importância de se criar uma especialidade que focasse na aquisição e interpretação de exames por imagem, sendo assim, a radiologia odontológica surgiu na odontologia (PAKCHOIAN et al., 2015; LANGLAND, 1995). O radiologista tem como seu objeto de estudo, a imagem, e tem como dever avaliar todo o exame por imagem, reportando em seu laudo qualquer alteração observada. Porém, não só o radiologista, mas outras especialidades lidam rotineiramente com métodos de imagem, uma delas é a Cirurgia e Traumatologia Buco-Maxilo-Facial (CTBMF) (LEE, 2013) que utiliza esse tipo de exame complementar em clínicas e hospitais para planejamento e acompanhamento de cirurgias ortognáticas, para instalação de implantes, exodontias e para diagnóstico e tratamento de fraturas e lesões. Muitas vezes, o cirurgião buco-maxilo-facial avalia as imagens de forma mais objetiva, analisando, principalmente, a região de interesse para o procedimento.

Apesar dos diferentes métodos de diagnóstico por imagem utilizados para detecção de CMB e FMA, um aspecto importante, considerando o diagnóstico radiográfico, é a habilidade e atenção do avaliador no momento da interpretação da imagem, e como se dá seu processo de decisão quanto a identificação dessas variações anatômicas da mandíbula. A maioria dos trabalhos não deixa claro quais critérios de seleção foram utilizados para selecionar os avaliadores, se esses são especialistas ou não, se tem experiência com diferentes exames por imagem, quantos avaliadores foram incluídos nos estudos, a correlação entre eles ou se os mesmos foram previamente treinados (HAAS et al., 2016).

Portanto, o objetivo do presente estudo foi avaliar a concordância entre profissionais das especialidades Radiologia Odontológica e Cirurgia e Traumatologia Buco-Maxilo-facial, e entre diferentes métodos de imagem, radiografia panorâmica e TCFC, na decisão de diagnóstico para canal mandibular bífido e forame mentual acessório.

2 ARTIGO

2.1 AGREEMENT BETWEEN ORAL AND MAXILLOFACIAL RADIOLOGISTS AND SURGEONS AND BETWEEN DIFFERENT IMAGING METHODS IN THE DIAGNOSTIC DECISION MAKING FOR BIFID MANDIBULAR CANAL AND ADDITIONAL MENTAL FORAMEN

Artigo submetido ao periódico Clinical Oral Investigations (Anexo 1)

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Abstract

Objectives. To evaluate the agreement between oral and maxillofacial radiologists (OMFR) and oral and maxillofacial surgeons (OMFS), and between panoramic radiograph (PAN) and cone beam computed tomography (CBCT), in the diagnosis of BMC and AMF. **Methodology.** Twenty examiners (n = 10 OMFR and n = 10 OMFS) assessed 30 PANs in the first moment and, after that 30 CBCT images from the same patients. To each hemimandible, it was used a 5-point scale for BMC and AMF diagnosis. Additionally, two other specialists, an OMFR and an OMFS were used as senior examiners. All imaging exams were analyzed in random order and were identified by a blinded code that permitted the association between them to the same patient. 10 PANs and 10 CBCT were reassessed to obtain intra-examiner agreement. Cohen's Kappa and Friedman's test (ICC = 95%) was used. **Results.** For BMC diagnosis, there was no agreement between OMFRs and OMFSs (p = 0.1005) and neither between the diagnosis in PAN and CBCT (p = 0.1005). A slight and significant agreement was found between the senior specialists, just for CBCT evaluations (p = 0.0462). In general, OMFS group did not present intra-examiner agreement; however, OMFR group ranged from fair to almost perfect in some cases for PAN and CBCT revaluations. For AMF, OMFRs produced higher kappa values than OMFSs, comparing CBCT evaluations (p=0.0106), but there was no significant difference when PAN method (p = 0.0679) was employed. For both groups, there was no agreement between the diagnosis in PAN and CBTC (p=0.0176, OMFS / p=0.0446, OMFR). A moderate agreement was found between the senior specialists in the CBCT evaluations (p = <0.0001). In general, the OMFS examiners presented no intra-examiner agreement for PAN and CBCT revaluations; however, it ranged from fair to substantial for OMFRs when they reassessed PAN and CBCT exams. **Conclusions.** The diagnosis of BMC is not uniform between OMFR and OMFS. There was no agreement between the diagnosis in PAN and CBCT evaluations. For the diagnosis of AMF, OMFRs obtained greater concordance than OMFS, regarding CBCT evaluation.

Keywords: Panoramic radiography; Cone Beam Computed Tomography; Oral Surgical Procedures; Anatomical variation.

Introduction

The mandibular canal and the mental foramen are usually considered single structures in each hemimandible; however, variations such as bifid mandibular canal (BMC) and additional mental foramen (AMF) have been reported by several studies [1-10]. Their occurrence is uncommon, but not rare [11], although they are still frequently underestimated in clinical practice [10].

These two structures have important clinical implications during oral procedures, such as implant placement, periapical surgery, teeth extraction, sagittal split ramus osteotomy, fracture osteosynthesis, bone block harvesting, root canal treatment of teeth, and lesions removal involving the mandible [5-8,11-14] because BMC and AMF contain the same nerves and vessels bundle that exist in the mandibular canal and in the mental foramen [10,11,15,16].

The gold standard for BMC and AMF detection is through experimental dissection or visual inspection of dry mandibles, but these methods are clinically inapplicable [19]. In case of clinic routine, imaging exams, mainly panoramic radiograph (PAN) and cone beam computed tomography (CBCT) are used, and the evaluation of BMC and AMF is often based on visual evaluations by a professional [20].

Therefore, it is essential that dentists who work with imaging modalities be familiar with the mandibular canal course and be able to diagnose its anatomical variations. Its identification can prevent potential transient or persistent complications (bleeding, paresthesia, traumatic neuroma and/or even disabling dysesthesia) [6,9,13,17,18] and helps in an adequate planning of the inferior alveolar nerve block [5,12].

Although the different diagnostic methods used to study the BMC and the AMF, the main methodological limitations recognized in the literature is about the examiners [21]. Most studies were uncertain or did not report the raters' specialty, the number of professionals that were involved in the image analysis, if they were previously trained or the correlation among them [21].

For that reason, agreement study is important to quality control of the specialty, development of technique and training [22]. Inter-examiner reproducibility can determine the degree of agreement among clinicians [22], helping in the development of diagnostic criteria [23], comparing the consistency of different fonts of diagnostic information [24], assessing the effects of educational formation and process of diagnostic decision making

[25], understanding variability in treatment planning [26] and determining the reliability of diagnostic tools.

Among the dental specialties, Oral and Maxillofacial Radiologists (OMFR) have focused in the acquisition and interpretation of imaging exams [27]. However, there are other dental specialists that deal in clinical routine with imaging methods, mostly Oral and Maxillofacial Surgeons (OMFS) that use them at clinics and hospital [28] to plan and follow up their procedures [29]. At the time of imaging interpretation, OMFS usually focuses on the region of interest for procedure often because it is practical. Nevertheless, OMFR must interpret and report the entire imaging exam. However, it is not known whether these fonts of information agree on their diagnoses with themselves and diffuse the same information to the patients and other professionals. Therefore, the aim of this study was to evaluate the agreement between OMFR and OMFS, two dental specialties that have intimated contact with imaging modalities, and between panoramic radiograph and CBCT, in the diagnostic decision making process to bifid mandibular canal and additional mental foramen.

Material and Methods

This study was approved without restrictions by the Research Ethics Committee (number: 59852516.9.0000.5418) and written informed consent was obtained from the volunteers/examiners of the study.

Sample

Twenty examiners, dentists and specialists, 12 males and 8 females, aged 24 to 35 years old (mean age of 29,5 years old) and with more than 2 years' experience with the studied imaging methods, were randomly selected. The sample was consisted by two groups: OMFR group (10 oral and maxillofacial radiologists with an average of 5.4 ± 2.4 years' experience) and OMFS group (10 oral and maxillofacial surgeons with an average of 5.4 ± 1.4 years' experience). Two senior researchers with 15 years' experience expertise, one OMFR and OMFS were selected as reference-standards for each dental specialty.

The expected agreement degree between OMFR and OMFS and the optimum number of exams that should be evaluated were previously estimated in a pilot study.

Sample size estimation was conducted a priori, using the Nomogram described by Hong et al. [30]. Considering a kappa coefficient of 0.4 as a minimum to be significant, 10 OMFR and 10 OMFS evaluating 60 imaging exams would achieve more than 90% power with a probability of alpha-type error of 0.05.

A total of 30 PANs and 30 CBCT volumes from the same patients, 12 males and 18 females, who were under preoperative radiographic evaluation for lower third molars extraction or implant placement were previously select. The inclusion criteria for this study was: patients with panoramic and CBCT images of the evaluated region taken within a small difference of time, CBCT images acquired with a FOV that comprehended the whole mandible; and the exclusion criteria were low quality images; images that presented artifacts or lesions in the region of interest.

The radiographic images were acquired with Orthopantomograph OP100 D (Instrumentarium Corp., Imaging Division, Tuusula, Finland), at 66 kVp, 2.5 mA, and acquisition time of 17.6 s and CBCT volumes acquired with an i-CAT Classic scanner (Imaging Sciences International, Inc, Hatfield, PA, USA), at 120 kVp, 8 mA, voxel size of 0.25 mm, and field of view of 13x17 cm.

Assessment of the images

Before the evaluations, all examiners were trained together and in a low-light room, with a review of slides on Microsoft® PowerPoint 2016 (Microsoft, Redmond, Washington, USA), depicting the definitions of mandibular canal and mental foramen and its most common anatomical variations (BMC and AMF). A group of patients presenting PAN and CBCT taken within a small difference of time, that were not used for the study, was selected for observer training.

After the training, PANs were initially distributed and assessed using JPEGview software. CBCT volumes were exported as a DICOM format file using Xoran® 3.1.62 software (Xoran Technologies, Ann Arbor, Michigan, USA), and then, they were given to the examiners and evaluated using Carestream CS 3D imaging software v3.1.9 (Carestream Health Inc., Rochester, USA). The assessments of the exams were performed dynamically, and the specialists were allowed to adjust contrast, brightness, and zoom settings on a 17in liquid crystal display (LCD) monitor with a resolution of 1024×768, in a low-light room. It was recommended an evaluation of 10 exams per day.

The specialists classified each hemimandible from the exams according to a scale of 5-points to measure the ability of certainty and uncertainty in the diagnose of BMC (figure 1) and FMA (figure 2): 1 – absent; 2 - probably absent; 3 – uncertainty; 4 - probably present; 5 – present.

The panoramic images and the CBCT volumes were analyzed in random order and independently. Each imaging exam was identified by a blinded code that permitted the association between them for the same patient.

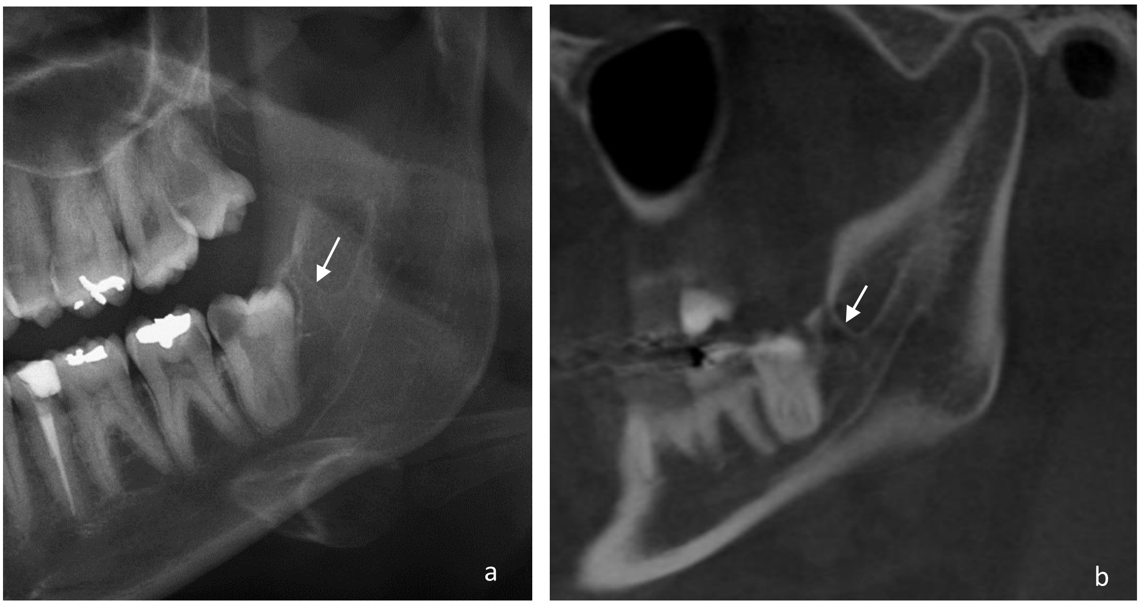


Fig1 Cropped panoramic radiograph (a) and modified sagittal CBCT image (b) showing the bifurcation of the mandibular canal (white arrows) adjacent to the lower left third molar (a,b)

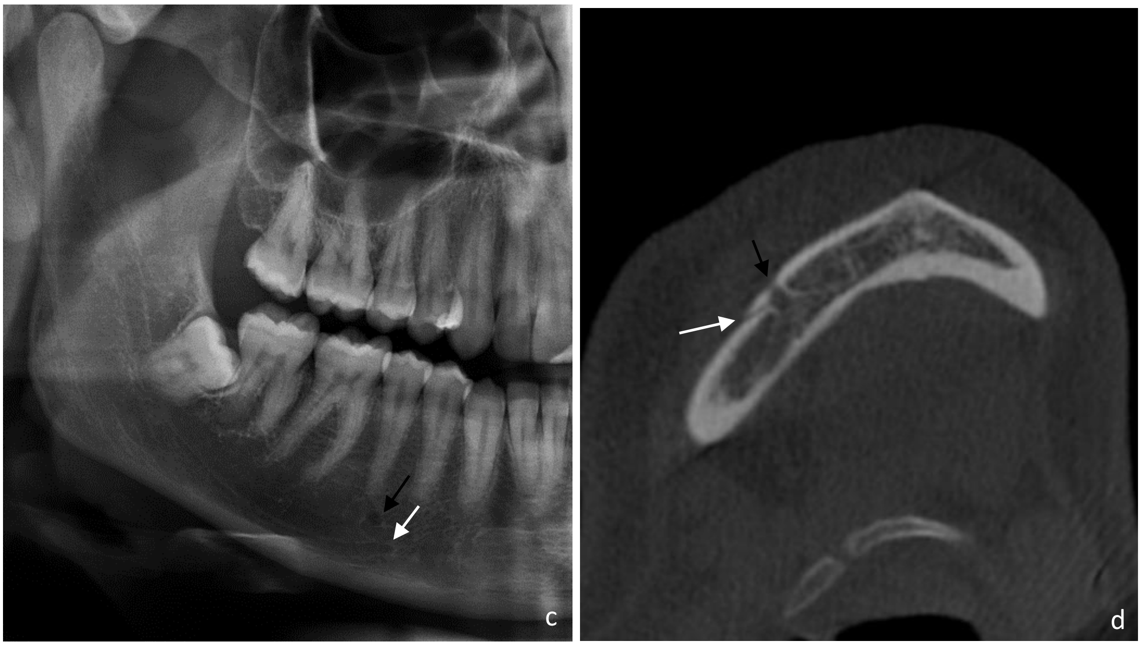


Fig2 Cropped panoramic radiograph (c) and modified axial CBCT image (d) showing additional mental foramen (white arrow) located above and distal to the mental foramen (black arrow)

After 2 weeks, the examiners reassessed 10 PANs and 10 CBCT images to obtain the intra-examiner agreement. Cohen’s kappa was used to assess intra- and inter-observer agreement, using the classification by Landis et al. [31]: <0 poor agreement; 0.00 - 0.20 slight agreement; 0.21 - 0.40 fair agreement; 0.41 - 0.60 moderate agreement; 0.61 - 0.80 substantial agreement; 0.81 - 1.00 almost perfect agreement. The Friedman's test compared the findings detected on panoramic and CBCT images, with a significance level of 0.05 (α=5 %).

Results

Bifid Mandibular Canal

Table 1 shows the agreement between the 10 OMFR and 10 OMFS examiners with their respective senior specialists.

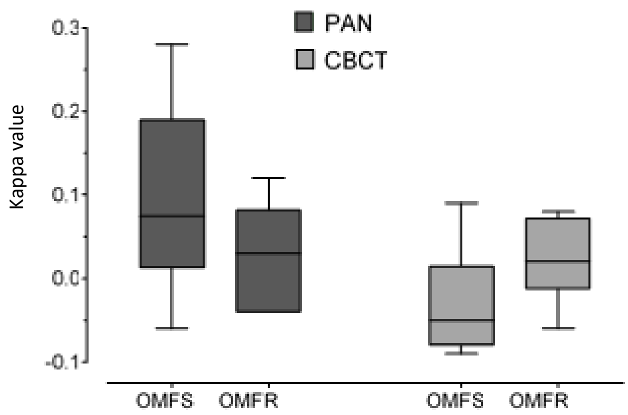
Table 1. Kappa values between examiners (OMFS and OMFR) with their correspondent benchmarks (OMFR and OMFS) using PAN and CBCT for bifid mandibular canal diagnosis.

	PAN		**CBCT**	
Examiner	**OMFS**	**OMFR**	**OMFS**	**OMFR**
1	0.28±0.09 (p=0.0008)*	0.07±0.04 (p=0.0677)	-0.03±0.06 (p=0.663)	0.05±0.07 (p=0.3865)
2	0.07±0.06 (p=0.1938)	0.04±0.09 (p=0.5946)	-0.09±0.06 (p=0.192)	0.08±0.1 (p=0.4174)
3	-0.06±0.07 (p=0.4160)	-0.04±0.09 (p=0.6595)	0.01±0.08 (p=0.9105)	-0.02±0.1 (p=0.8581)
4	0.08±0.06 (p=0.1383)	-0.04±0.07 (p=0.5441)	-0.08±0.06 (p=0.2136)	0.0±0.07 (p=1.0)
5	0.22±0.1 (p=0.0135)*	0.06±0.06 (p=0.3218)	0.09±0.1 (p=0.3206)	0.02±0.09 (p=0.8222)
6	-0.01±0.07 (p=0.8722)	0.12±0.11 (p=0.1851)	0.03±0.07 (p=0.6949)	0.02±0.11 (p=0.85)
7	0.14±0.07 (p=0.0267)*	-0.04±0.07 (p=0.5568)	-0.05±0.08 (p=0.4809)	0.08±0.06 (p=0.1892)
8	0.02±0.08 (p=0.8056)	0.12±0.1 (p=0.0999)	-0.05±0.05 (p=0.4167)	0.07±0.09 (p=0.4111)
9	0.05±0.05 (p=0.3249)	0±0.02 (p=0.899)	-0.08±0.06 (p=0.193)	-0.01±0.02 (p=0.6103)
10	0.18±0.09 (p=0.0172)*	0.02±0.03 (p=0.2927)	-0.08±0.07 (p=0.2923)	-0.06±0.05 (p=0.2567)

* (p < 0.05)

According to table 1, only four OMFS examiners obtained a range from slight to fair and significant agreement with the OMFS senior specialist in the PAN evaluations. The Friedman's test showed that there were no statistically significant differences ($p = 0.1005$) between kappa values from OMFS and OMFR groups (figure 3).

Fig3 Boxplot of the relationship of kappa values between OMFS and OMFR groups and between panoramic radiograph and CBCT for bifid mandibular canal diagnosis. Friedman's test.



The agreement between the OMFR and OMFS senior specialists in PAN and CBCT evaluations are shown in table 2 and 3. There was a slight and significant agreement between the evaluations performed by senior specialists, using CBCT. For PAN and CBCT evaluations done by OMFR senior, there was no agreement. Also, for OMFS senior using PAN and OMFR senior using CBCT, there was no agreement.

Table 2. Agreement between OMFR senior in CBCT with OMFS senior in panoramic radiograph and CBCT for bifid mandibular canal diagnosis.

		OMFR senior (CBCT)							
		1 (n=42)	2 (n=0)	3 (n=0)	4 (n=0)	5 (n=18)	Total (n=60)	Cohen's Kappa	p value
OMFS senior (CBCT)	1	28	0	0	0	10	38	0.18	0.0462*
	2	0	0	0	0	1	1		
	3	0	0	0	0	0	0		
	4	11	0	0	0	0	11		
	5	3	0	0	0	7	10		
OMFS senior (PAN)	1	28	0	0	0	6	34	0.20	0.501
	2	0	0	0	0	1	1		
	3	0	0	0	0	0	0		
	4	4	0	0	0	4	8		
	5	10	0	0	0	7	17		
OMFR senior (PAN)	1	35	0	0	0	14	49	0.03	0.79
	2	0	0	0	0	0	0		
	3	0	0	0	0	0	0		
	4	0	0	0	0	1	1		
	5	7	0	0	0	3	10		

* $p < 0.05$

Moreover, there was no agreement between PAN and CBCT evaluations, regarding the OMFS senior (table 3).

Table 3. Agreement between OMFS (CBCT) and OMFS (PAN) senior for bifid mandibular canal diagnosis.

		OMFS senior (CBCT)							
		1 (n=38)	2 (n=1)	3 (n=0)	4 (n=11)	5 (n=10)	Total (n=60)	Cohen's Kappa	p value
OMFS senior (PAN)	1	24	1	0	5	4	34	0.09	0.30
	2	1	0	0	0	0	1		
	3	0	0	0	0	0	0		
	4	3	0	0	2	3	8		
	5	10	0	0	4	3	17		

The intra-examiner agreement is shown in table 4. It is possible to observe that for PAN evaluations, only 4 OMFS obtained a range from slight to moderate and significant agreement between the first and second evaluations. However, only 1 OMFS obtained a fair and significant agreement for CBCT evaluation. The intra-agreement for OMFR group ranged from fair to almost perfect and significant in some cases for PAN and CBCT evaluations.

Table 4. Intra-examiner agreement kappa values for bifid mandibular canal diagnosis.

	OMFS		OMFR	
Examiner	**PAN**	**CBCT**	**PAN**	**CBCT**
1	0.11±0.12 (p=0.3987)	0.12±0.11 (p=0.2699)	0.6±0.15 (p<0.0001)*	0.58±0.14 (p<0.0001)*
2	0.17±0.16 (p=0.2257)	0.15±0.18 (p=0.3632)	0.49±0.18 (p=0.0001)*	0.34±0.17 (p=0.0356)*
3	0.08±0.12 (p=0.484)	0±0.12 (p=1)	0.19±0.17 (p=0.2523)	0.4±0.13 (p=0.0045)*
4	-	0.18±0.12 (p=0.0568)	0.04±0.12 (p=0.7383)	0.32±0.19 (p=0.0582)
5	0.42±0.15 (p=0.0044)*	-0.19±0.13 (p=0.2771)	0.26±0.13 (p=0.0337)*	0.41±0.15 (p=0.0027)*
6	0.18±0.15 (p=0.2265)	0.2±0.14 (p=0.081)	0.1±0.08 (p=0.2439)	0.25±0.2 (p=0.1991)
7	0.2±0.12 (p=0.036)*	-0.11±0.09 (p=0.3649)	0.08±0.12 (p=0.4711)	0.11±0.11 (p=0.3233)
8	-0.08±0.13 (p=0.498)	0.11±0.1 (p=0.2561)	0.5±0.19 (p=0.001)*	0.1±0.15 (p=0.4496)
9	0.29±0.11 (p=0.0045)*	0.3±0.15 (p=0.0135)*	0.36±0.15 (p=0.0302)*	0.85±0.13 (p<0.0001)*
10	0.18±0.15 (p=0.1626)	0.1±0.14 (p=0.4101)	0.27±0.17 (p=0.0775)	0.04±0.15 (p=0.7889)

* $p < 0.05$

Table 5 shows the intra-examiner agreement between OMFR and OMFS seniors. For both imaging methods, the OMFR senior obtained a moderate and significant agreement. For OMFS senior using PAN, the intra-examiner agreement was fair, and when CBCT were reevaluated, the OMFS senior had a substantial agreement.

Table 5. The intra-examiner agreement of the OMFS and the OMFR seniors for bifid mandibular canal diagnosis.

			Second assessment						
Exam	Senior Examiner	First assessment	1	2	3	4	5	Cohen's Kappa	p value
PAN	OMFR	**1**	17	0	0	0	0	0.47	0.0039*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	1	0	0	0	0		
		5	1	0	0	0	1		
	OMFS	**1**	11	0	0	0	0	0.31	0.0005*
		2	0	1	0	0	0		
		3	0	0	0	0	0		
		4	0	0	0	0	0		
		5	4	1	0	3	0		
CBCT	OMFR	**1**	14	0	0	0	0	0.58	0.0041*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	0	0	0	0	0		
		5	3	0	0	0	3		
	OMFS	**1**	12	0	0	1	0	0.79	<0.0001*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	1	0	0	0	0		
		5	0	0	0	0	6		

* $p < 0.05$

Additional Mental Foramen

Table 6 shows the agreement between the 10 OMFR examiners and the 10 OMFS examiners with their respectively seniors specialists.

Table 6. Kappa values between the examiners of each group (OMFR and OMFS) with their correspondent senior specialists (OMFR and OMFS) for additional mental foramen diagnosis.

	PAN		CBCT	
Examiner	**OMFS**	**OMFR**	**OMFS**	**OMFR**
1	0.06±0.06 (p=0.2409)	0.05±0.09 (p=0.5695)	0.01±0.07 (p=0.8856)	0.06±0.12 (p=0.6215)
2	0.15±0.07 (p=0.0285)*	0.17±0.09 (p=0.0179)*	0.01±0.09 (p=0.8927)	0.05±0.12 (p=0.7019)
3	0.06±0.07 (p=0.3536)	0.01±0.08 (p=0.8455)	0.2±0.11 (p=0.0094)*	0.21±0.13 (p=0.0779)*
4	0.13±0.06 (p=0.0189)*	0.03±0.06 (p=0.5462)	0.02±0.05 (p=0.604)	-0.01±0.11 (p=0.9183)
5	0.04±0.07 (p=0.5226)	0.02±0.04 (p=0.6503)	-0.12±0.03 (p=0.2582)	0.15±0.1 (p=0.083)
6	0.04±0.07 (p=0.5448)	-0.05±0.03 (p=0.4781)	-0.01±0.08 (p=0.8514)	0.02±0.13 (p=0.8472)
7	0.18±0.07 (p=0.003)*	0.02±0.07 (p=0.7547)	0.04±0.09 (p=0.631)	0.18±0.1 (p=0.0484)*
8	0.1±0.07 (p=0.1359)	0.03±0.07 (p=0.6656)	0.04±0.06 (p=0.4025)	0.19±0.14 (p=0.136)
9	-0.04±0.04 (p=0.3589)	-0.01±0.01 (p=0.6908)	0.03±0.05 (p=0.5268)	-
10	0±0.05 (p=0.9722)	0.04±0.03 (p=0.0772)	0±0.07 (p=0.9579)	0.14±0.12 (p=0.2008)

* p < 0.05

The agreement between the examiners and their respective senior specialist, in general, was classified as slight or fair, when significant. However, the Friedman's test showed that there were higher kappa values when CBCT imagens were evaluated, comparing with PAN evaluations (p=0.0176, OMFS / p=0.0446, OMFR). The OMFR group produced higher kappa values than OMFS group when both used CBCT (p = 0.0106), but there were no statistically significant differences when PAN method (p = 0.0679) was employed (figure 4).

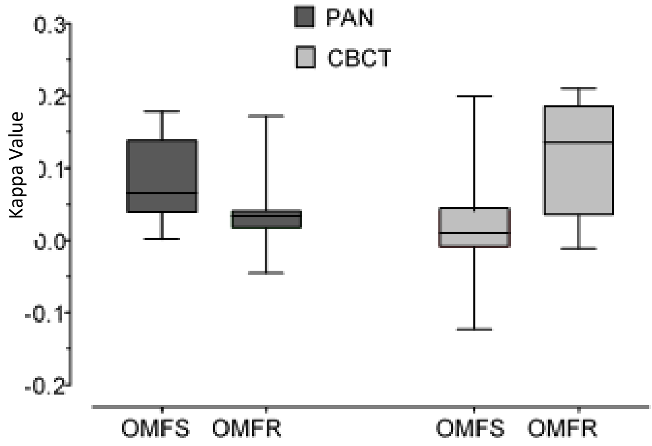


Fig4 Boxplot of the relationship of kappa values between OMFS and OMFR groups and between panoramic radiograph and CBCT to additional mental foramen diagnosis. Friedman's test.

The agreement between the OMFR senior and the OMFS senior in PAN and CBCT assessments is shown in tables 7 and 8.

Table 7. Agreement between OMFR senior using CBCT with OMFS senior in panoramic radiograph and CBCT evaluations for additional mental foramen diagnosis.

		OMFR senior (CBCT)							
		1 (n=45)	2 (n=0)	3 (n=0)	4 (n=0)	5 (n=15)	Total (n=60)	Cohen's Kappa	p value
OMFS senior (CBCT)	1	43	0	0	0	8	51	0.46	<0.0001*
	2	2	0	0	0	0	2		
	3	0	0	0	0	0	0		
	4	0	0	0	0	1	1		
	5	0	0	0	0	6	6		
OMFR senior (PAN)	1	33	0	0	0	14	47	-0.17	0.14
	2	0	0	0	0	0	0		
	3	0	0	0	0	0	0		
	4	3	0	0	0	0	3		
	5	9	0	0	0	1	10		
OMFS senior (PAN)	1	29	0	0	0	9	38	0.01	0.92
	2	1	0	0	0	1	2		
	3	0	0	0	0	0	0		
	4	8	0	0	0	3	11		
	5	7	0	0	0	2	9		

* $p < 0.05$

There was a moderate and significant agreement between the senior specialists, when both examiners used CBCT; however, there was no significant agreement when the OMFR senior analyzed CBCT and PAN. Table 8 shows that there was also no agreement between the CBCT and PAN assessment for OMFS senior.

Table 8. Agreement between OMFS senior using CBCT and PAN for additional mental foramen diagnosis.

		OMFS senior (CBCT)							
		1 (n=51)	2 (n=2)	3 (n=0)	4 (n=1)	5 (n=6)	Total (n=60)	Cohen's Kappa	p value
OMFS senior (PAN)	1	33	1	0	1	3	38	0.02	0.78
	2	1	0	0	0	1	2		
	3	0	0	0	0	0	0		
	4	9	1	0	0	1	11		
	5	8	0	0	0	1	9		

The intra-examiner agreement for AMF diagnosis is shown on table 9. In general, the OMFS examiners presented no agreement for PAN and CBCT revaluations. Except for 2 OMFS that obtained a fair agreement when they reassessed PAN, and for only 1 OMFS that showed a slight agreement in CBCT revaluation. The intra-examiner agreement ranged from fair to substantial and significant for OMFR when they reassessed the PAN and CBCT images.

Table 9. Intra-examiner agreement kappa values for additional mental foramen diagnosis.

	OMFS		OMFR	
Examiner	**PAN**	**CBCT**	**PAN**	**CBCT**
1	0.02±0.1 (p=0.8633)	-0.01±0.11 (p=0.9467)	0.45±0.16 (p=0.0015)*	0.51±0.21 (p=0.0032)*
2	0.11±0.15 (p=0.4367)	0.18±0.14 (p=0.0737)	0.44±0.33 (p=0.0469)*	0.37±0.2 (p=0.0514)
3	-0.02±0.08 (p=0.8739)	-0.07±0.15 (p=0.5599)	0.17±0.14 (p=0.1736)	0.59±0.2 (p=0.0016)*
4	-	0.12±0.11 (p=0.2907)	0.16±0.14 (p=0.2053)	0.45±0.2 (p=0.0208)*
5	0.34±0.16 (p=0.0282)*	-0.06±0.15 (p=0.672)	0.21±0.18 (p=0.1839)	0.72±0.14 (p=0)
6	-0.18±0.11 (p=0.0761)	-0.07±0.13 (p=0.5018)	-0.05±0.04 (p=0.8139)	0.76±0.15 (p=0.0004)*
7	0.33±0.15 (p=0.0066)*	0.16±0.09 (p=0.0164)*	0.21±0.11 (p=0.0275)*	0.17±0.12 (p=0.1545)
8	0.04±0.14 (p=0.7229)	0.07±0.12 (p=0.5988)	0.65±0.32 (p=0.0001)*	0.63±0.17 (p=0.0004)*
9	0.17±0.11 (p=0.1034)	-0.01±0.13 (p=0.9311)	0.16±0.22 (p=0.4305)	0.73±0.13 (p=0.0001)*
10	0.21±0.12 (p=0.106)	0.12±0.16 (p=0.3151)	-0.12±0.12 (p=0.5007)	0.33±0.17 (p=0.0304)*

* $p < 0.05$

Table 10 shows the intra-examiner agreement for OMFR and OMFS seniors. It is possible to observe when the OMFS benchmark reassessed both imaging methods, the agreement was substantial and significant. For OMFR benchmark, the intra-examiner agreement was moderate and significant in CBCT revaluation.

Table 10. The intra-examiner agreement of the OMFS and the OMFR seniors for additional mental foramen diagnosis.

			Second assessment						
Exam	**Senior Examiner**	**Firth assessment**	**1**	**2**	**3**	**4**	**5**	**Cohen's Kappa**	**p value**
PAN	**OMFR**	**1**	18	0	0	0	0	-	-
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	0	0	0	0	0		
		5	2	0	0	0	0		
	OMFS	**1**	14	1	0	0	0	0,77	<0.0001*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	0	1	0	4	0		
		5	0	0	0	0	0		
CBCT	**OMFR**	**1**	15	0	0	0	0	0,50	0,0098*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	0	0	0	0	0		
		5	3	0	0	0	2		
	OMFS	**1**	18	0	0	0	0	0,64	0,0021*
		2	0	0	0	0	0		
		3	0	0	0	0	0		
		4	0	0	0	0	0		
		5	1	0	0	0	1		

*p < 0.05

Discussion

To the best of our knowledge, this is the first study to compare the agreement between dental specialists, oral and maxillofacial radiologists and oral and maxillofacial surgeons, in the diagnostic decision making process to bifid mandibular canal and additional mental foramen, and the agreement between the diagnosis obtained in panoramic radiographs and CBCT images from the same patients. As far as we know, the agreement between examiners has not been investigated in depth through suitable statistical methods, and most of the available studies have only described the presence or absence of BMC and FMA, considering just the potential influencing factors in the imaging methods without evaluating the importance of the examiners in the imaging interpretation.

The ideal number of examiners for studies with BMC and AMF is not known yet, however, when the literature mentioned the number of examiners involved in this type of investigation, it is shown a rate of 1 to 3 observers, which the kappa test, in most studies, was reported as moderate or was not mentioned at all [21]. The current study included a relatively large number of examiners (n = 20) with a similar educational background, level of training and experience time, which permit obtain more precise kappa values with possible reproducibility for other clinicians [22]. However, it was expected that increasing the number of examiners, the chance to obtain high reproducibility among them could decreased [32].

Elstein [25] identified critical characteristics of the decision making process and called it of hypothetic-deductive method. This theory explains that when professionals found a common situation in the clinic (i.e. periapical cyst), it decreases doubts during diagnostic. They produce diagnostic hypotheses more clearly and search for supplementary information to confirm just one of them. In our case, the BMC and AMF are uncommon conditions, what can cause doubts in the process of diagnostic hypothesis formulation and, finally, in the decision. We are in accordance with Elstein [25], once the more unusual is a condition, more increase the uncertainty in the diagnostic during the exam interpretation.

Bifid mandibular canal

Deep knowledge of vital anatomical structures such as mandibular canal and their anatomic variations is fundamental to obtain satisfactory results during and after surgical procedures involving mandible [3,8,33].

The reproducibility evaluation data of this study showed that inter-examiner agreement between both OMFR and OMFS groups was not significant ($p > 0.05$), even between professionals from the same area of specialty, expressing that the diagnosis of BMC is not clear, and the diagnostic decision making process for this type of condition may differ from one examiner to the another, even if they have the same educational background and training. Even between the senior specialists (OMFR and OMFS), the inter-examiner agreement was poor and not significant, confirming that the BMC diagnosis is hard. This study showed that there was no statistical difference between the both groups of specialists nor between the imaging methods used, what means that the educational formation for each specialty nor the imaging exam improved the decision making process for the diagnosis of BMC.

Comparing the kappa values from intra-examiner agreement, the OMFR group had more specialists that obtained agreement in the revaluation, what express that the oral and maxillofacial radiologists created diagnosis criteria for BMC and kept them in the second evaluation. The OMFR group had the same average time as specialists as the OMFS group, nevertheless OMFRs see images in a different way, with the responsibility to report alterations, so even though the average time in the specialty was similar with OMFS, the nature of the specialty is very much different, and in this case, experience as oral and maxillofacial radiologists was important.

The choice of a hypothesis is part of this diagnostic judgment process and it can be based on the combination of the professional intuition and analytical thinking skills [34]. The more the specialist devotes himself in the diagnostic and has experience, the faster and the more accurate is the hypothesis formulation, decreasing the doubts in the final diagnosis [35]. According to our results, the senior specialists obtained higher degree of certainty for BMC diagnosis, once they chose more defined points in the 5-point scale (1 – absent; 5 - present). On the other side, the specialists of OMFR and OMFS groups selected usually the undefined points (2 - probably absent; 3 – uncertainty; 4 – probably preset). Thus, we are in accordance with Brush and Brophy [34]. We also believe that when the specialist has much experience, it increases the degree of certainty in the choice of a diagnostic hypothesis.

Another method that some clinicians can use in the decision making process and can elucidate the differences among the evaluations of our examiners is that frequently the clinician creates only one hypothesis for the condition, and all data gathering is to confirm this tentative of diagnosis [35]. If the specialist uses this method, it can lead a misinterpretation of BMC. Once the professional does not know about BMC, this anatomical variation can be always confounded with just milo-hyoid line in PAN or bone trabeculae in CBCT images. In fact, BMC misdiagnosis can increase the probability to occur complications during surgical procedures [19].

Observing the agreement between the senior specialists, and the points from 5-point scale selected by them, it is possible to detect that they refereed more absences than presences of BMC in the exams. We believe that it can be explained by this method, once the specialists are not used to seeing BMC in their clinical routine, and even with training, in most cases, they believe that there was just milo-hyoid line or bone trabeculae. We recommend that the OMFR and OMFS should be more familiar with the different conformations of anatomic structures in the mandible and its anatomic variations on imaging exams. However, it can also indicate that there are many true negative cases of BMC in our sample, and when the BMC is not present, the diagnostic is clear.

According to this study, there was no difference between both imaging modalities ($p > 0.05$) for BMC diagnosis, what is in line with Neves et al. [19]. However, due to the low kappa values for PAN and CBCT evaluations, we believe that the image of the milo-hyoid line and a dense trabecular bone can be confounded with BMC and underestimate the presence of true bifid mandibular canal in imaging exams [7,19,21].

Besides the tridimensional images from intra-bone structures showed by CBCT, results observed in the present study suggest that BMC is not easy to be observed, even in this imaging method or it seems that most of the specialists did not know what they should recognize as BMC. Therefore, both OMFRs and OMFSs can give different diagnosis for the same patient’s exam.

Additional mental foramen

The inter-examiner agreement between each examiner and its corresponding senior specialist for both imaging exams have demonstrated that the diagnosis of AMF is also controversy and it can depend on how the process of decision making influences in the diagnostic by each examiner. Moreover, AMF can be presented in various forms and sizes. Deeper knowledge on the normal anatomy and anatomical variations of the mandible may improve the diagnosis of AMF. Deeper knowledge on the normal anatomy and mandible anatomical variations may improve the AMF diagnosis. The more the clinicians devote themselves in the interpretation task and acquire knowledge, the more they improve the diagnostic decision making process, decreasing doubts and uncertainty [35].

The inter-examiner agreement found in this study for OMFR and OMFS seniors showed that the diagnosis of AMF in CBCT was clearer than in PAN. We believe that the experience with the tridimensional exam can lead to a better evaluation of the mandible cortical and facilitate the AMF diagnosis.

The number of absence answers given by the senior specialists when accessing AMF is interesting information. Senior specialists tend to present higher agreement when choosing the absent score (1) of the 5-point confidence scale. This same finding was observed for BMC diagnosis, and can indicate that even specialists have difficulties identifying AMF or that negative cases are easier to identify.

The relationship between OMFR and OMFS examiners with their correspondent senior specialists shows that the OMFRs produced higher kappa values for inter-examiners agreement when both groups used CBCT ($p < 0.05$). This fact can be explained by the greater proximity of OMFR with this tridimensional exam and the imaging software used in this study.

It is important to emphasize that agreement studies should not be confused with studies of accuracy [36]. Our objective was not assessed the correct diagnosis of the BMC and AMF but evaluate the agreement between specialists and the degree of certainty in the diagnostic decision making. The current study does not provide a new clinical decision making tool to be used in the diagnosis of these anatomical variations, but it does provide the actual situation of agreement between medical information, trying to draw attention to the diagnosis of anatomical conditions that are clinically important.

Intra-examiner kappa values show that most oral and maxillofacial radiologists obtained good and significant reproducibility for AMF diagnosis using CBCT scans; however, that did not happen for PAN evaluated by OMFR and for PAN and CBCT evaluated by OMFS. The fact that OMFR are more familiar with imaging software such as CS 3D and that they went through a previous evaluation using the same criteria to detect AMF may have influenced on the OMFR higher intra-examiner agreement values.

OMFS or any other dental or health professional, when referring a patient to an OMFR, should send the maximum clinical information, medical history (i.e. failures in anesthetic efficacy during the surgical procedure, important complications during oral surgery) and any other patients' complaints to better guide the OMFR during image assessment, in order to improve the diagnosis of AMF and BMC.

Conclusion

There was no agreement between OMFS and OMFR on BMC diagnosis using panoramic radiograph and CBCT; thus, these anatomical variations diagnosis is still a challenge for health professionals. The diagnostic decision making for AMF is clearer among OMFR using CBCT.

Conflict of Interest: The authors declare that they have no conflict of interest.
Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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3 CONCLUSÃO

Em geral, o CMB é uma estrutura de difícil diagnóstico, uma vez que não há concordância entre os profissionais da radiologia odontológica e nem entre os especialistas da cirurgia e traumatologia buco-maxilo-facial. Também não há concordância entre os diagnósticos, utilizando radiografia panorâmica e tomografia computadorizada de feixe cônico. Para o diagnóstico de FMA, ambos os grupos de especialistas obtiveram maiores concordâncias quando utilizaram TCFC e, além disso, os radiologistas odontológicos obtiveram maior concordância do que os cirurgiões buco-maxilo-faciais, considerando esse mesmo método de imagem.

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* De acordo com as normas da UNICAMP/FOP, baseadas na padronização do International Committee of Medical Journal Editors - Vancouver Group. Abreviatura dos periódicos em conformidade com o PubMed.

APENDICE 1

METODOLOGIA DETALHADA

3.1 Local da pesquisa

Este estudo foi desenvolvido no Departamento de Diagnóstico Oral, área de Radiologia Odontológica da Faculdade de Odontologia de Piracicaba (FOP-Unicamp), Piracicaba, SP.

3.2 População e Amostra

O estudo foi composto por dez especialistas em Cirurgia Buco MaxiloFacial (CBMF) e dez especialistas em Radiologia Odontológica com mais de dois anos de experiência.

Cada grupo avaliou imagens panorâmicas (PAN) e imagens de tomografia computadoriza de feixe cônico (TCFC) de 30 pacientes provenientes de um banco de imagens da Clínica de Radiologia Odontológica da FOP-Unicamp, aprovado junto ao sistema CEP-CONEP.

3.3 Critérios de Inclusão

- Cirurgiões-dentistas com especialização em CBMF e Radiologia Odontológica, com pelo menos 2 anos de experiência e com mais de 18 anos de idade;
- Imagens provenientes de pacientes com mais de 18 anos de idade, que tivessem radiografias panorâmicas e TCFC obtidas em momentos próximos;
- Imagens panorâmicas e de TCFC que não apresentem erros de posicionamento e/ou presença de lesões e região de mandíbula;
- Radiografias panorâmicas e exames de TCFC sem artefatos em região de corpo e ramos da mandíbula.
- Campos de visão de exames de TCFC que compreendessem toda a mandíbula.

3.5 Avaliação das imagens

Sessenta exames, 30 radiografias panorâmicas e 30 tomografias computadorizadas de feixe cônico dos mesmos pacientes foram previamente selecionadas por um pesquisador, de acordo com os critérios de inclusão.

Dois pesquisadores com experiência em radiologia odontológica avaliaram todas as imagens separando os exames com suspeita de presença de canal mandibular bífido (n = 10), forame mentual acessório (n = 10) e com suspeita de ausência das duas condições (n = 10).

Dois avaliadores, um pesquisador e especialista em Radiologia Odontológica e um pesquisador e especialista em Cirurgia Buco Maxilofacial (CBMF), ambos com mais de 15 anos de experiência, avaliaram os 60 exames de forma independente, e atribuíram um código para cada hemimandíbula, sendo eles: 1 - ausente; 2 - provavelmente ausente; 3 - incerteza; 4 - provavelmente presente; 5 - presente.

Os mesmos exames foram avaliados por 2 grupos de especialistas: um grupo composto por cirurgiões-dentistas especialistas em CBMF (n=10); e outro grupo composto por cirurgiões-dentistas especialistas em Radiologia Odontológica (n=10).

Todos os avaliadores foram treinados no mesmo dia, em uma sala com baixa iluminação, através de uma apresentação de slides no software PowerPoint 2016 (Microsoft, Redmond, Washington, EUA), onde os mesmos foram projetados em uma tela branca com o auxílio de um projetor. Foram expostas as definições de canal da mandíbula, forame mentual acessório, canal mandibular bífido e forame mentual acessório, bem como foram esclarecidos os critérios de classificação para os mesmos. Uma série de casos, que consistia em imagens panorâmicas e de TCFC de pacientes sem variações anatômicas no canal mandíbula e com presença de CB e FMA também foi apresentada, a qual não continha as imagens que seriam utilizadas para posterior avaliação pelos examinadores.

As imagens foram divididas em dois grupos de acordo com o tipo de exame (radiografia panorâmica ou TCFC), foram aleatorizadas e distribuídas, independente do grupo ao qual pertenciam, para garantir uma avaliação cega.

Os avaliadores examinaram, primeiramente, todas as imagens panorâmicas e, depois, todas as imagens de TCFC em um monitor de display de cristal líquido (LCD) de 17 polegadas com uma resolução de 1024 × 768, em uma sala com pouca luz e utilizaram os softwares JPEGview, para avaliação das radiografias panorâmicas e Carestream 3D viewer versão 3.5.7, para avaliação dos exames de TCFC.

Foi permitido aos observadores, o ajuste das ferramentas de contraste, brilho e zoom nos dois softwares e, nas imagens de TCFC, ainda poderiam realizar a avaliação de forma dinâmica.

Os especialistas também classificaram cada hemimandíbula de acordo com a escala de 5 pontos descrita acima. Para evitar fadiga visual, foi recomendado para que cada especialista avaliasse, no máximo, 10 imagens de radiografia panorâmica e 10 imagens de TCFC por dia. Após 15 dias do término das avaliações, os especialistas reavaliaram 20 exames por imagem (10 radiografias panorâmicas e 10 TCFC) da mesma amostra para medir o grau de concordância intraobservador.

3.6 Análise estatística

Os dados referentes às avaliações foram tabulados em planilhas do programa Microsoft Office Excel e submetidos à análise estatística, onde foram utilizados o teste Kappa para verificar a correlação inter e intraobservador e o teste de Friedman para detectar diferenças entre as avaliações e os métodos de imagem utilizados (radiografias panorâmicas e TCFC).

ANEXO 1

COMITÊ DE ÉTICA EM PESQUISA
FACULDADE DE ODONTOLOGIA DE PIRACICABA
UNIVERSIDADE ESTADUAL DE CAMPINAS

CERTIFICADO

O Comitê de Ética em Pesquisa da FOP-UNICAMP certifica que o projeto de pesquisa "**Influência da especialidade odontológica na detecção de variações anatômicas mandibulares**", protocolo CAAE nº **59852516.9.0000.5418**, dos pesquisadores **Larissa Moreira de Souza, Francisco Haiter Neto, Francisco Carlos Groppo e Luciana Asprino**, satisfaz as exigências das resoluções específicas sobre ética em pesquisa com seres humanos do Conselho Nacional de Saúde – Ministério da Saúde e foi aprovado por este comitê em **19/01/2017**.

The Research Ethics Committee of the School of Dentistry of Piracicaba of the University of Campinas (FOP-UNICAMP) certifies that research project "**Influence of dental specialty in the detection of mandibular anatomic variation**", CAAE **59852516.9.0000.5418**, of researchers **Larissa Moreira de Souza, Francisco Haiter Neto, Francisco Carlos Groppo and Luciana Asprino**, meets the requirements of the specific resolutions on ethics in research with human beings of the National Health Council - Ministry of Health and was approved by this committee on **01/19/2017**.

Fernanda Miori Pascon

Profa. Fernanda Miori Pascon

Vice Coordenador
CEP/FOP/UNICAMP

Prof. Jacks Jorge Junior

Coordenador
CEP/FOP/UNICAMP

Nota: O título do protocolo e a lista de autores aparece como fornecidos pelos pesquisadores, sem qualquer edição.
Notice: The title and the list of researchers of the project appears as provided by the authors, without editing.

ANEXO 2

Submissions Being Processed for Author Larissa Moreira de Souza, DDS

Page: 1 of 1 (1 total submissions) Display 10 results per page.

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links	CLOI-D-18-00045	AGREEMENT BETWEEN ORAL AND MAXILLOFACIAL RADIOLOGISTS AND SURGEONS AND BETWEEN DIFFERENT IMAGING METHODS IN THE DIAGNOSTIC DECISION MAKING TO BIFID MANDIBULAR CANAL AND ADDITIONAL MENTAL FORAMEN	12 Jan 2018	12 Jan 2018	Submitted to Journal

Page: 1 of 1 (1 total submissions) Display 10 results per page.

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