Prognosis for the impacted lower third molars: Panoramic reconstruction versus tomographic images

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Objective. The aim of this cross-sectional accuracy study was to compare panoramic reconstruction (PR) and multiplanar reconstruction (MPR) images, which are used to establish the prognosis for impacted mandibular third molars in relation to professional decision making.

Study Design. Images of 10 patients who had undergone cone beam computed tomography (CBCT) examination were selected, resulting in 2 distinct groups of images, with 10 in each group: PR and MPR. To check prognostic accuracy, 2 images from each group were randomly selected and reinserted into the sample, totaling 24 images. A questionnaire was completed by 54 professionals: 27 orthodontists and 27 oral and maxillofacial surgeons (OMFSs). Data were evaluated by using the χ^2 and McNemar's tests and Kappa statistics at $P < .05$.

Results. There were no statistically significant differences when isolated PR images were compared with MPR images by orthodontists ($P = .72$) or OMFSs ($P = .45$). However, there were significant differences in the professional decision regarding the prognosis for impacted teeth, where OMFSs indicated the need for more extractions compared with orthodontists ($P < .0001$).

Conclusions. There are no differences between PR and multiplanar CBCT images with regard to the determination of the prognosis for impacted mandibular third molars. However, there was a difference in the decision making between the different specialties. (Oral Surg Oral Med Oral Pathol Oral Radiol 2020;130:625−631)

Third molars are the teeth that are most affected by the impaction process.[1,2] Thus, in 75% of patients presenting at dental offices on a regular basis, the third molars are removed.[3] Many studies have been conducted with the aim of clarifying doubts regarding the prognosis for these teeth.[4-6] However, conflicting results have hindered the professional decision-making process. This lack of concordance in the literature has led to third molar extractions not based on clearly defined criteria.[7]

To assist in diagnosis, panoramic radiography (PR) has been used. However, with this modality, there are overlaps of anatomic regions that are fundamental for decision making, leading, in many cases, to the need to use other imaging modalities, such as cone beam computed tomography (CBCT).[8] The literature reports that whether panoramic radiographs are evaluated in isolation[5] or serially,[4,6] the risk of errors increases while establishing the prognosis for eruption of the lower third molars. The conclusion is that orthodontists and oral and maxillofacial surgeons (OMFSs) are unable to predict the eruption of these teeth exclusively on the basis of these sources of images.[4-6] A study by Haney et al.[1] suggested that the use of 2-dimensional (2-D) and 3-dimensional (3-D) images of impacted maxillary canines can result in different diagnoses and treatment plans for the same patient.

Thus, this study compared PR and CBCT images to establish the prognosis for impacted mandibular third molars according to the specialist decision to extract them.

MATERIAL AND METHODS

This cross-sectional accuracy study was approved by the Human Research Ethics Committee of the University Federal of Pará (No. 1851957) and followed the guidelines of the Helsinki Declaration. Free and informed consent forms were signed by all patients involved in this study. Furthermore, a database consent form was signed by the radiologist who provided the tomographic images of his patients.

Images of 10 patients, 5 males and 5 females, who underwent CBCT examination were selected. They were obtained from the same dental radiology clinic by using the same acquisition protocol (ICat Classic, field of view [FOV] 6 × 16 cm; voxel size 0.25 mm; 120 kvp; and 5 mA for 40 seconds). Inclusion criteria were age 14 to 24 years (mean 17.1 years); asymptomatic third molars; and different stages of root formation and dental positioning. Patients with craniofacial anomalies and tooth loss were excluded.

Statement of Clinical Relevance

The prognosis for impacted mandibular third molars is not influenced by imaging modalities and panoramic or multiplanar reconstruction. However, the decision making process is different between orthodontists and oral surgeons, regardless of the type of image evaluated.

The cases were classified according to the criteria proposed by Winter.[9] There were 6 cases (cases 1, 4, 6, 7, 8, and 10) in the mesioangular position, 1 (case 3) in linguoversion, and 3 (cases 2, 5, and 9) in the vertical position (Figures 1 and 2).

The CBCT images were classified into 2 distinct groups, containing 10 images each: PR group and multiplanar reconstruction (MPR) group. Demographic data, such as age and gender, were added. Two images from each group were randomly selected to determine the accuracy of the diagnostic evaluations.

Twenty-seven orthodontists and 27 OMFSs evaluated 24 images. The number of professionals used in this study was based on a previous study.[4] The professionals were randomly selected from a list generated by the regional council of dentistry in the state of Pará, Brazil.

The PR images were presented by experts as a slide show with the use of Microsoft PowerPoint 2013 program (Microsoft Corp., Redmond, WA). A blackboard was inserted in the hemiarch opposite the selected one to remove possible confounding factors. The images of the MPR group were visualized and manipulated by using the software program ImplantViewer 3 (Anne Solutions, São Paulo, SP, Brazil), in coronal, sagittal, and axial sections. The evaluators had previous training on the software.

The professionals were asked to complete at different times a questionnaire containing dichotomous questions regarding the professional's approach to the lower third molars. In it, the evaluator could opt for clinical follow-up or exodontia of the tooth examined.[3]

Statistical analysis

After collection, data were tabulated by using Microsoft Excel 2013 (Microsoft Corp., Redmond, WA) and then submitted to kappa, χ^2, and McNemar's tests by using BioEstat 5.3 software (Mamirauá Conservation of Amazon Institute) and VassarStats: Website for Statistical Computation (Vassar College, Poughkeepsie, NY).

RESULTS

The different modalities of images, specialties, and decision making of the professionals were grouped separately. The agreement analysis of replicated cases (n = 2) was substantial for most cases, with the kappa value varying between 0.73 and 0.82, except for cases of PR images analyzed by orthodontists, which revealed moderate agreement with values of 0.56.

Once the error of the method was validated, a comparison of the responses from the different professionals involved in this study was performed for each imaging modality in isolation (Table I). The results of these comparisons allowed us to infer that there was a low concordance between (OMFSs and orthodontists in relation the prognosis for impacted third molars;
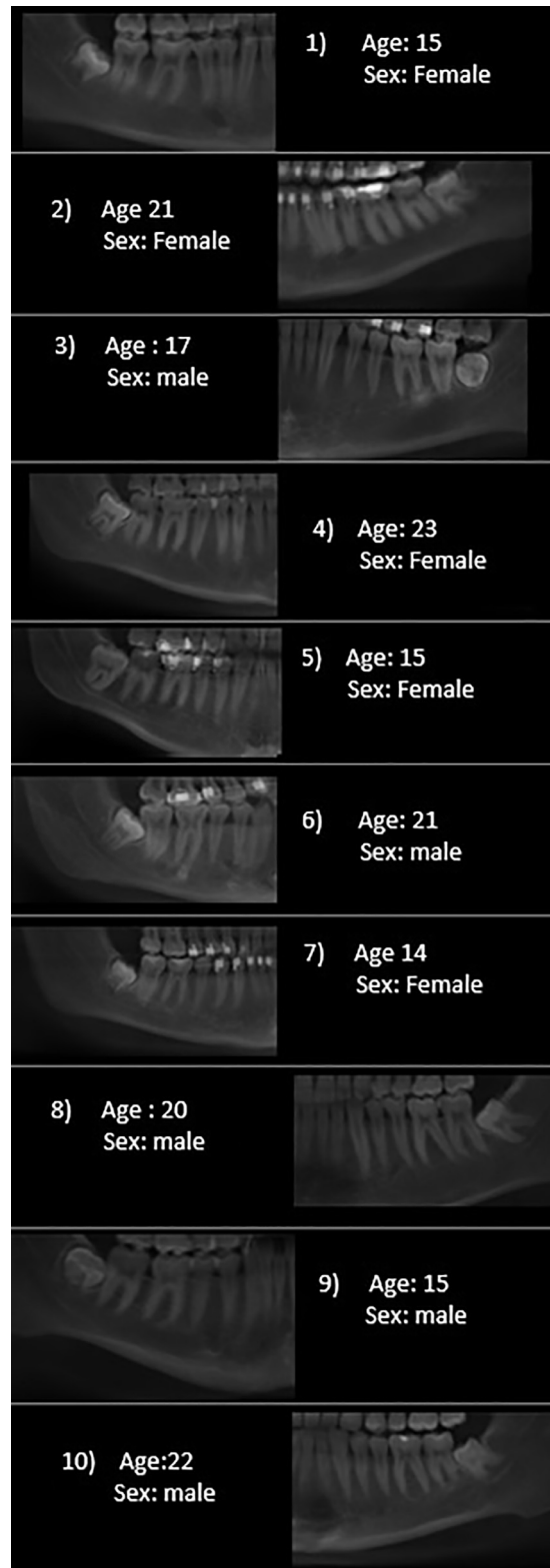

Fig. 1. Illustrative frames of panoramic radiography (PR) of third molars in selected cases.

$P < .0001$). OMFSs indicated the need for more extractions compared with orthodontists, whereas
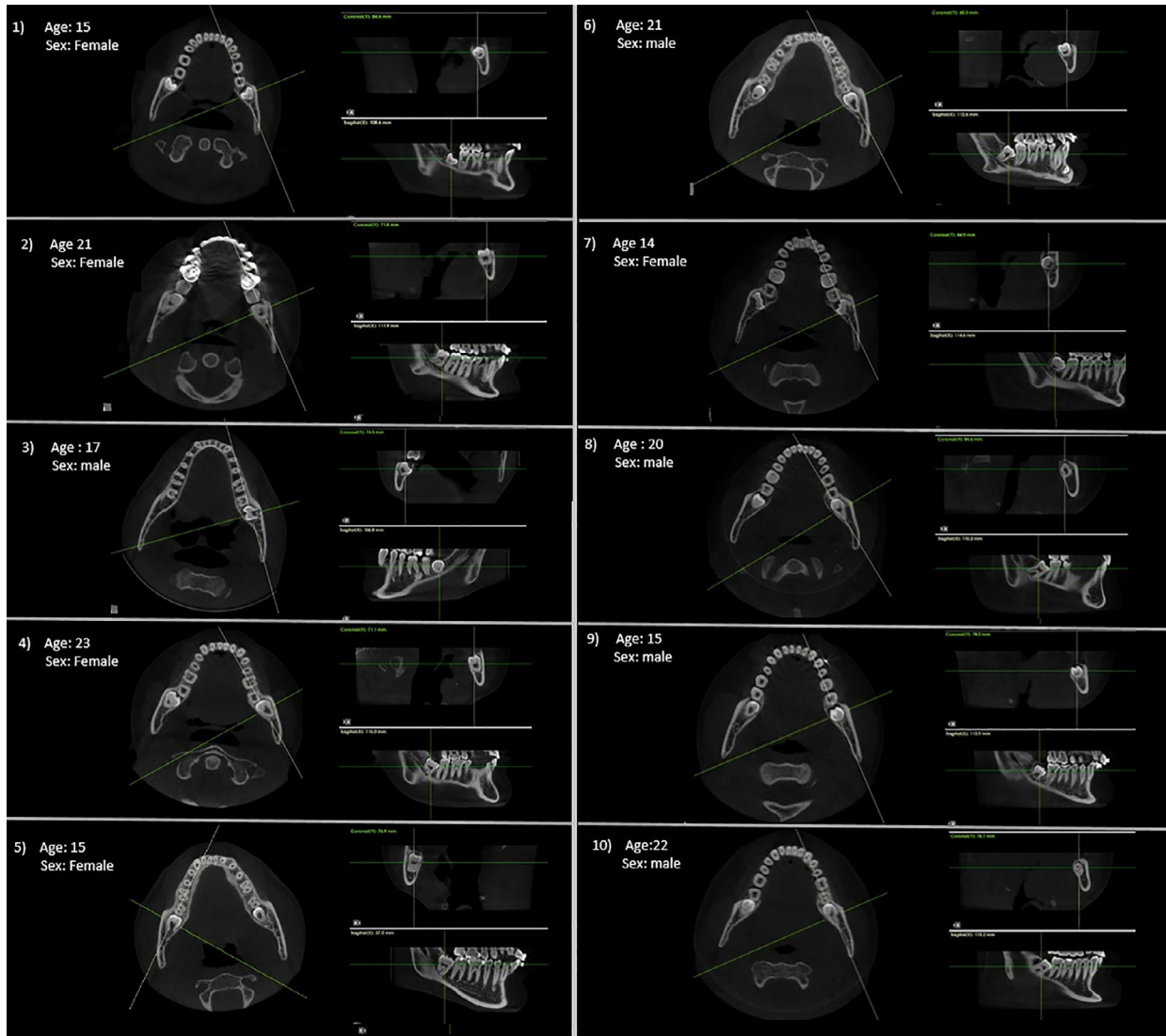
Fig. 2. Illustrative frames of multiplanar reconstruction (MPR) of the lower third molars—axial, coronal, and sagittal views—in selected cases.

Table I. Intergroup comparison: professional approaches of OMFSs and orthodontists in relation to impacted lower third molars, with use of different diagnostic tools

Panoramic Reconstruction

	OMFS	Ortho	Total	
Exo	260 (80%)	167 (52%)	427	$\chi^2 = 59.391$
Follow-up	64 (20%)	157 (48%)	221	
Total	324 (100%)	324 (100%)	648	$P < .0001$

Multiplanar Reconstruction

	OMFS	Ortho	Total	
Exo	250 (77%)	172 (53%)	422	
Follow-up	74 (23%)	152 (47%)	226	$\chi^2 = 41.337$
Total	324 (100%)	324 (100%)	648	$P < .0001$

Exo, exodontia; *OMFS,* oral and maxillofacial surgeons; *Ortho,* orthodontists.

orthodontists showed a similar frequency between follow-up and exodontia (Figures 3 and 4).

When considering changes in the dental arch related to growth, it was observed that OMFSs indicated the need for more extractions than follow-up for patients older or younger than 17 years of age, differing from orthodontists, who reported follow-up more for cases of mandibular third molars in patients who were in a growth stage (Figures 5 and 6).

When evaluating the results of comparison of PR and MPR images used independently to establish the prognosis for the impacted third molars included in the study (Tables II and III), it was observed that there were no statistically significant differences regarding professional decision making when modifying the image modality independent of the specialty evaluated (OMFSs $P = .45$ and orthodontists $P = .72$).
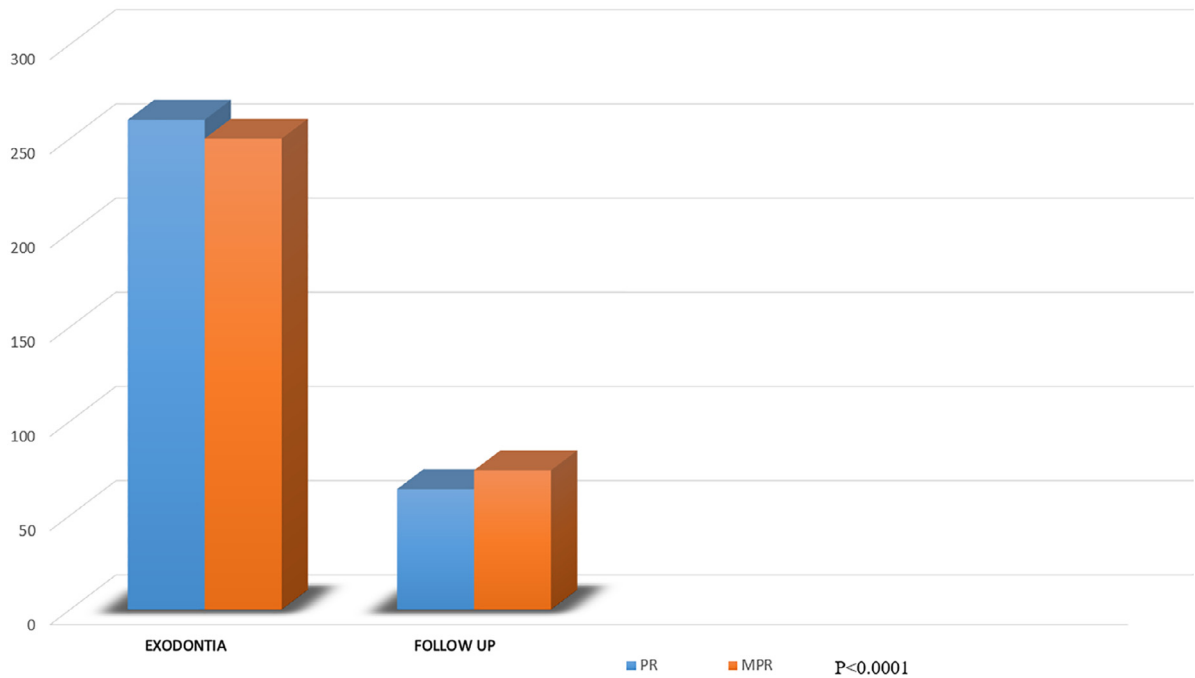
Number of treatment indication

Fig. 3. Assessment of oral and maxillofacial surgeons (OMFSs) with regard to the prognosis for impacted third molars by using different imaging modalities.

DISCUSSION

The development and eruption of third molars are routinely monitored by dentists.[10] Although they are the teeth most affected by the impaction process,[1,2,11,12] surgical treatment is still a controversial subject in dentistry. Although OMFSs support the idea of early treatment, other professionals prefer not to expose patients to unnecessary risks.[13-15]
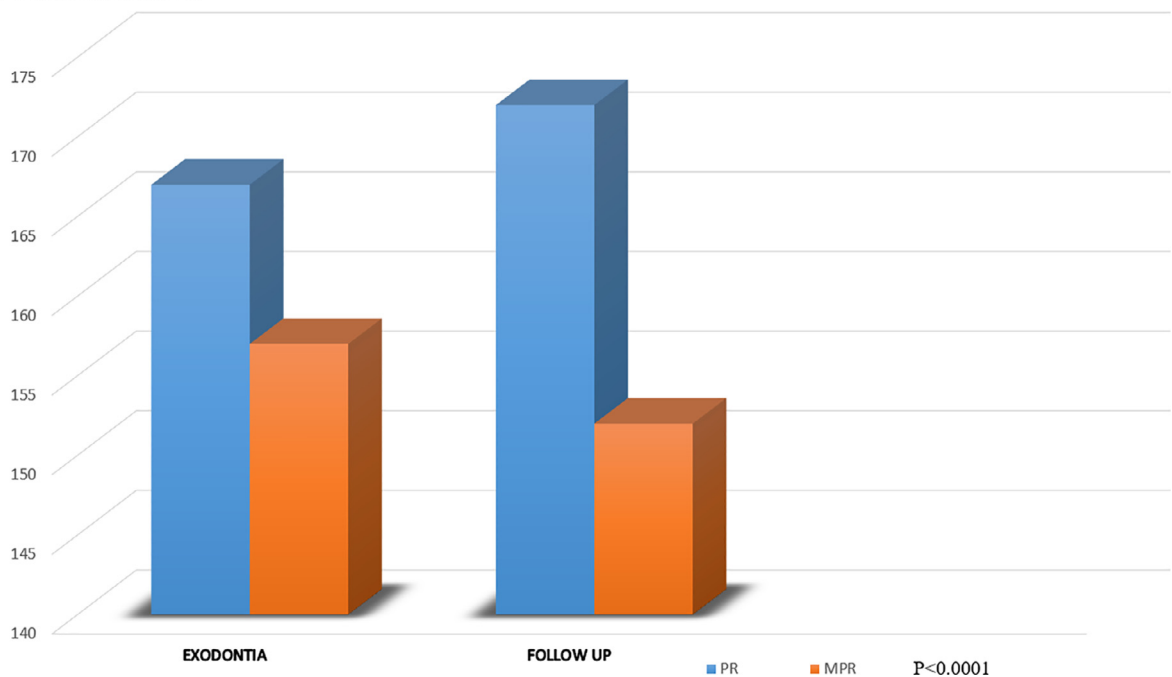
Number of treatment indication

Fig. 4. Assessment of orthodontists with regard to the prognosis for impacted third molars by using different imaging modalities.
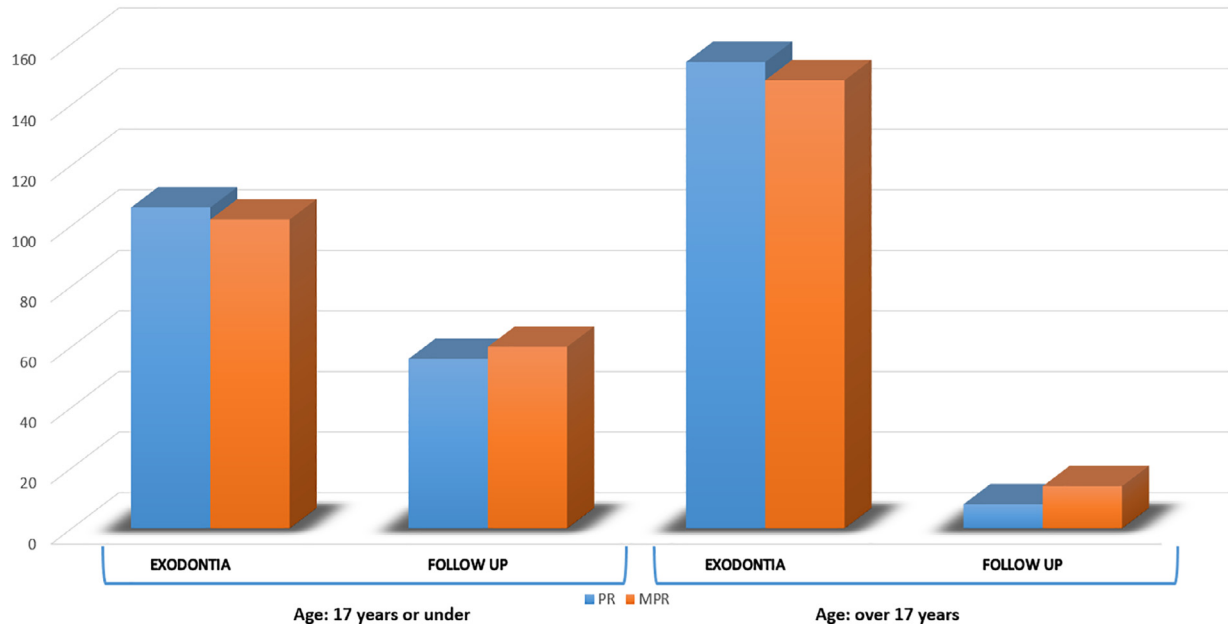
Number of treatment indication

Fig. 5. Assessment by age of oral and maxillofacial surgeons (OMFS) with regard to the prognosis for impacted third molars by using different imaging modalities in patients age 17 years or less and patients older than 17 years of age.

Specialists in the area have doubts regarding waiting to confirm if these teeth will erupt spontaneously or will remain without changes in their position or angulation over time.[16] Previous studies have reported that orthodontists and OMFSs are unable to predict eruption of these teeth by exclusively using panoramic radiography,[5] including serial ones.[4,6]

When examining CBCT images, our findings revealed that there is low agreement between OMFSs and orthodontists with regard to professional decision making. OMFSs indicated the need for more exodontia (80% in the PR group and 77% in the MPR group) compared with orthodontists (52% PR and 53% MPR). These data agree with those of previous studies[4-6] using
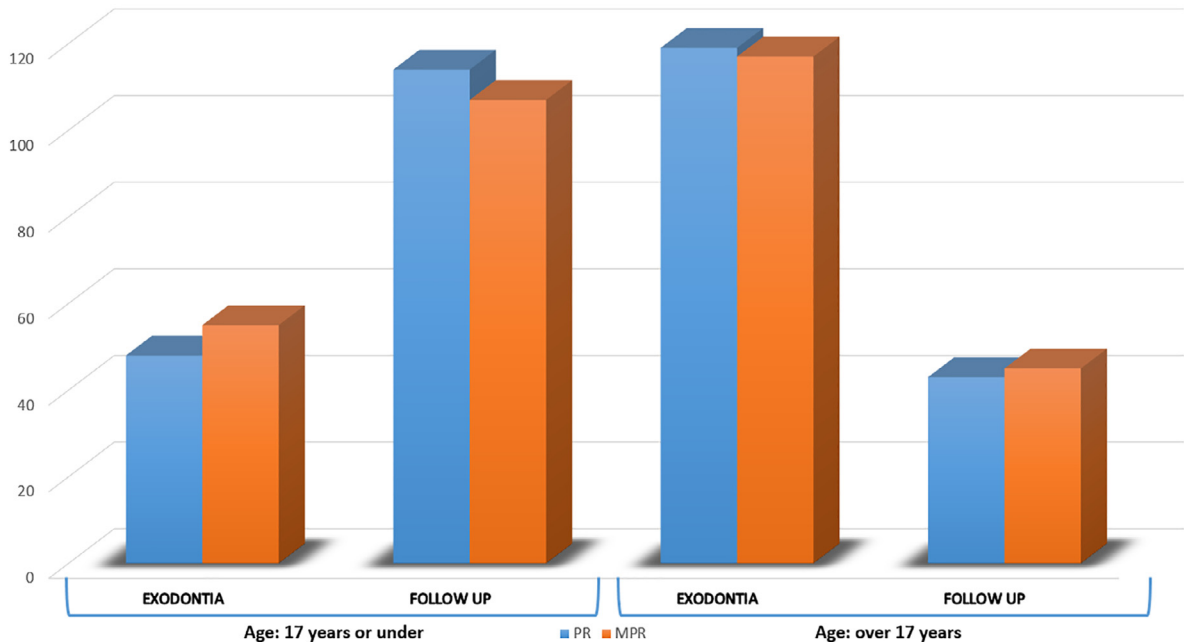
Number of treatment indication

Fig. 6. Assessment by age of orthodontists with regard to the prognosis for impacted third molars by using different imaging modalities in patients age 17 years or less and patients older than 17 years of age.

Table II. McNemar's test for intergroup comparison: PR and MPR referring to the prognosis for impacted third molars (n = 24), performed by oral and maxillofacial surgeons

		OMFS PR			
		Exo	Follow-up	Total	P = .4554
MPR	Exo	510	314	824	
	Follow-up	334	138	472	
	Total	844	452	1296	

Exo, exodontia; *MPR,* multiplanar reconstruction; *OMFS,* oral and maxillofacial surgeons; *PR,* panoramic reconstruction.

Table III. McNemar's test for intergroup comparison: PR and MPR referring to the prognosis for impacted third molars (n = 24), performed by orthodontists

		Ortho PR			
		Exo	Follow-up	Total	
MPR	Exo	339	329	668	P = .7237
	Follow-up	319	309	628	
	Total	658	638	1296	

Exo, exodontia; *MPR,* multiplanar reconstruction; *Ortho,* orthodontists; *PR,* panoramic reconstruction.

PR. This divergence in determining the prognosis between the different specialties evaluated in this study may be related to lack of establishment of a specific protocol[17] in reference to the lower third molars. Because impaction prediction has not been scientifically proven yet, it is daunting to predict this biologic condition with any degree of reliability.[16]

The greater number of extraction reported by OMFSs can be explained by the consensus among the majority of professionals in this specialty that in cases where there is clinical or radiologic evidence of acute or chronic periodontitis, caries, pericoronitis, harmful effects, or pathologies in the second molars, surgery can be justified in spite of the risks of or the complications resulting from the procedure.[18,19]

Orthodontists may report more follow-up of the mandibular third molars because during orthodontic treatment changes, occur in the arch; this leads to postponing of decision making until the end of treatment and increased confidence in the choices made by these professionals.

Although this study revealed a high rate of third molar extractions, mainly reported by OMFSs, the results may have been underestimated. The presence of the researcher during administration of the questionnaire may have functioned as an inhibitory factor,[4] causing the specialists to report fewer cases of exodontia.

It was also observed that when completing the questionnaires, OMFSs demonstrated greater ease in the manipulation of CBCT images compared with the great majority of orthodontists. This probably resulted from the more frequent use of this imaging modality by OMFSs in their daily clinical practices.

Although PR aids in determination of the vertical position and horizontal angulation of impacted elements, in some cases, it is necessary to use additional radiographs to verify the 3-D shape of the exact location.[1] CT has proven to be more accurate than 2-D techniques, such as radiography.[20] However, the high dose of radiation that the patient is exposed to during the examination contraindicates the use of this tool in routine clinical practice for assessment of impacted teeth.

This study investigated differences in the professionals' approach to lower third molars in relation to the diagnostic tools used in isolation. The results led us to believe that regardless of the specialty evaluated, modification in the use of PR for MPR does not ensure achieving more accurate prognoses for impacted lower third molars. Therefore, it is up to the professional to establish which image modality is more appropriate for each case.

We decided to use CBCT images because it would be ethically unacceptable to subject patients to unnecessary amounts of radiation. By using CBCT, MPR made it possible to create images, including the 2-D ones, in real time and in several planes, to obtain replicas of traditional radiographs.[21,22] It is known that CBCT provides the professional with the possibility of obtaining all conventional 2-D images that are required for orthodontic documentation, in addition to detailed 3-D views of dentofacial structures.[23] Furthermore, it allows to visualization of 3-D structures of teeth and surrounding tissues,[24,25] thus contributing to optimal surgical management.[26]

The estimated value of the sample selected in this study can be justified because with each selected patient, 2 different imaging modalities (PR and MPR) could be evaluated. In addition, few evaluators would agree to participate in research with such a large volume of images to be evaluated, either for the amount of time required or even for the fatigue resulting from the evaluation process.

Limitations

This study applied the questionnaire at different times and differentiated between the cases of asymptomatic lower third molars and those of different angulations and stages of root development. However, the quantity of tomographic images that came from the different groups may have caused the evaluator to recognize specific characteristics in each case, resulting in similar responses for the different diagnostic tools studied.

The exclusive use of PR and MPR images for establishing diagnoses was another limitation. Although demographic data, such as patient gender and age, were included in the analysis of images, many professionals felt the need for detailed information about the clinical examination to substantiate their responses. Another limitation of this study is as follows: When manipulating the ImplantViewer 3 software to evaluate the tomographic images of the MPR group, the evaluator had access to the whole image; thus, features present in the hemi-arch opposite to that evaluated, such as impacted or poorly positioned teeth, may have functioned as confounding factors in the establishment of the professional decision.

CONCLUSIONS

There is no difference in determining the prognosis for impacted mandibular third molars with use of PR or MPR. Regardless of the type of image examined OMFSs indicated the need for more extractions compared with orthodontists. Thus, it appears that the approach to prognostic assessment depends more on the type of specialist than on the imaging modality.

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