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CONGRESS PROCEEDING

Assessment Of Juxta-Apical Radiolucency With Cone Beam CT

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Abstract

Purpose: This study aimed to investigate the association of Juxta-Apical Radiolucency (JAR) with third molar status and mandibular canal and also describe its radiologic features through cone beam computed tomography (CBCT).
Methods: CBCT images of 100 individuals (153 mandibular third molars) were evaluated for the presence of JAR. Than, the CBCT images were analysed to evaluate the position of the JAR and its relationship to the impacted teeth, mandibular canal and buccal-lingual cortical plates. Descriptive statistical analyses were used.
Results: JAR was identified in 70 individuals and 95 mandibular third molars (48 right side, 47 left side). 22 of the individuals with JAR were male and 48 were female. It was found that 26 (27,4%) of the 95 third molars were erupted, 10 (10,5%) were partially erupted, 59 (62,1%) were impacted. 74,7 % were on the apical third of the root and the rest was located along the mesial or distal surfaces of root. Close proximity to the buccal cortical plate was seen in 25,35 % of JAR located apically, whereas it was seen only 25% of JAR located along the root surface. Only 23.4 % were associated with the mandibular canal.
Conclusion: The present study gives an insight into the relationship of JAR with mandibular canal and cortical plates using CBCT. However, future studies are warranted that use a larger sample size to validate the above findings.

Key words: Mandible; Radiolucency; Third Molar Teeth

Introduction

Surgical extraction of mandibular third molars is a common procedure in dental practice. To minimize the post-operative complications, the surgeon should have relevant information about the third molars, such as the inclination of the tooth root/s to the buccal or lingual cortical plate and the course of the mandibular canal in relation to the root.[1] Pre-operative image evaluation of third molars is essential to clarify the relationship between these teeth and adjacent anatomical structures. The Juxta-Apical Radiolucency (JAR) is a well-defined radiolucent area located laterally and in continuity with the root apexes of healthy third molars and it has been considered an image created by cancellous bony architecture instead of pathology.[2–4] JAR, that has been described recently, has been pointed out as possible predictor of inferior alveolar nerve (IAN) injury during tooth removal.[3] JAR can also cause thinning of the cortical layer when positioned lingually resulting in lingual nerve damage. Lingual cortical plate thinning is an important feature in causing lingual nerve damage during third molar removal.[1] Cone beam computed tomography (CBCT) which is excellent in detecting such anatomical variations provides accurate 3-dimensional (3-D) images of hard tissue and their relations with surrounding anatomical structures.[5] Knowledge of the JAR's radiographic feature, such as gender predisposition, location of the root as mesial/distal, close proximity of buccal/lingual cortical plates, relationship between presence of JAR and status of mandibular third molars as errupted or impacted, the radiographic relationship with the mandibular canal, might help oral surgeons and dental practitioners, distinguishing pathological or anatomical variation, enlightening the surgical planning and enabling good communication with patients.[2] The aim of this study was to assess presence of JAR and its radiological features, the status of related tooth in alveolar bone and its relationship between adjacent teeth and anatomical structures on CBCT images.

Methods

TThe approval from the Ethical Committee of Lokman Hekim University, Ankara, Turkey, was obtained for this study (Protocol No: 2021-008). A retrospective study was carried out to analyse the JAR presence on CBCT for initial sample of 100 patients (153 mandibular third molars). 70 individuals of them had JAR and composed the final sample. 22 of the individuals with JAR were male and 48 were

female and mean (SD) age 36 (14) years, range (17–79). JAR was examined in a total of 95 mandibular third molars (48 right side, 47 left side), which were included in the study regardless of their eruption status. Images with artifacts that would degrade image quality of the relevant region and the third molars with caries, restoration and any other conditions such as cysts or tumours, were excluded from this study. CBCT images were acquired with Planmeca Promax 3D (Planmeca) cone-beam CT unit device with a voxel size of 0.20 mm with a special mode field of view of 16 x 4-12 cm. The slice thickness of the multiplanar reconstruction images was 1 mm. JAR was identified as a well-circumscribed radiolucent area in the multiplanar sections, lateral to the root of the mandibular third molars, and separated from the surrounding structures by the cortical border. CBCT scans were analysed to assess the presence, site of the JAR and its relations to the mandibular canal, buccal or lingual cortical plates, tooth position, and condition of apex of the root in the axial, coronal, sagittal, cross-sectional planes and in reformatted panoramic views. Radiological evaluations were made by one dentomaxillofacial radiologist, one with 2-year experience (SC). The observer examined whether the presence or absence of JAR and the defined JAR position was related to the position of the roots. These positions were described as mesial, distal, buccal, lingual, apical and lateral surface of the roots. The relation between the mandibular canal and JAR was examined as in contact or separate. The positional close proximity of the JAR to the mandibular cortical bone was detected as buccal, lingual or between roots. In addition, we recorded whether or not there was a cortical perforation. The status of third molars was examined as errupted, partially impacted or impacted Figure 1. After two weeks, 20% of the images were reassessed for consistency by the observer.

For descriptive statistics, mean and standard deviation are given for numerical variables, and number and percentage values are given for categorical variables. Whether there was a difference between the groups was examined with the significance test of the difference between the two averages in numerical variables. The relationship between categorical variables was analyzed using the chi-square test. The significance level was taken as $p<0.05$. Statistics were made with IBM SPSS v.22.

Results

JAR presence was seen in 70 individuals of initial sample. JAR was most frequently found female than male (68,6%). No statistically significant difference was observed in the right-left side distribution of the mandibular third molar teeth in JAR presence. (p=0.889) JAR significantly associated with apical positioning of the mandibular third molar root (p = 0.003), which occurred in 74,7% of cases of the JAR group. Just one case (1,05%) positioned in mesial surface of the root in relation to third molar and the rest was located along the distal surfaces of root (24,2%). The anatomic relationship between JAR and the mandibular canal revealed that in most cases the JAR was separated with the canal, 76,6 % of cases of the JAR group and also there was no cortical perforation found in this study. JAR presence was significantly associated with status of teeth (p= 0.035), 62,1% of cases of the JAR group was impacted, 27,4% of them was erupted, 10,5% of them was partially erupted. JAR showed a statistically significant association in positional relation to mandibular cortical plate as buccal, lingual or between roots. (p=0.021) Close proximity to the buccal cortical plate was seen in 25,3 % of JAR located apically, whereas it was seen only 25% of JAR located along the root surface. Table 1 describes patients' demographic features and summarizes the association of third molar status and radiographic signs of proximity with JAR.

Table 1. Descriptive analysis of juxta-apical radiolucency (JAR) and its association with surrounding anatomical structures

Variables	Number (%)	p Value
JAR presence/absence:	100	
Present	70(70)	
Absent	30(30)	
Distribution of gender with JAR	70	
Male	22(31,4)	
Female	48(68,6)	
Distribution of teeth with JAR	95 (100)	
Right mandibular third molar	48(50,5)	0.889
Left mandibular third molar	47(49,5)	
Position in relation to third molar		
Apical	71 (74,7)	0.003
Mesial Surface of the Root	1 (1,05)	
Distal Surface of the Root	23 (24,2)	
Relation of JAR to mandibular canal		
Contacting	22(23.4)	
Separated	73(76,6)	
Status of Third Molar Teeth		
Erupted	26 (27,4)	0.035
İmpacted	59 (62,1)	
Partially erupted	10 (10,5)	
Positional relation of JAR to mandibular cortical plate		
Buccal	26 (27,4)	0.02
Lingual	44(46,3)	
Between Roots	25 (26,3)	

Discussion

Preoperative identification of potential risk factors for nerve damage is essential for safe surgical treatment of the mandibular third molars. Owing that JAR presence is pointed out as a predictor of injuries, its pre-operative detection is important to estimate the possible outcome related to third molar surgery.[3] In this context, the CBCT stands out as a valuable imaging choice since it produces three-dimensional information of the radiographic signs of proximity to the anatomical structures.[5] It was first described by Renton et al.[3] who conducted a controlled clinical trial and found a significant association between the presence of JAR and the occurrence of nerve injuries during third molar surgery. Since then, studies have been performed using CBCT.[2,4,6] Published JAR-related studies are limited. In the present study, the presence of JAR and its relation with anatomical structures were evaluated on CBCT images in a small group of Turkish patients. JAR was detected 70% of 100 individuals, 22 of them was male, 48 of them was female. There was no statistically significant difference between right and left side. Unlike the present study, Nascimento et al had stated that JAR was present in 15.9% of 252 patients with CBCT.[2]Yalçın and Artaş A detected JAR in 33% of patients and 20% of third molars on CBCT images.[7] In previous studies, no significant relations were found between the location of the JAR and the dental surfaces.[2,8] Nascimento et al.[8] was reported that it was distal or mesial to the third molar in 72.9% and in another study, Nascimento et al.[9] distal to the third molar in 66%. The findings of this study showed a significant difference for the position in relation to third molar statistically. JAR significantly associated with apical positioning of the mandibular third molar root (74,7%). Unlike to this study, Yalçın and Artaş[7] found a significant relation between the site of the JAR and dental surfaces, which was mostly mesial (43.4%) to the third molar. The present study showed a relation between the location of the JAR and mesial root surface just for one case (1,05%). The anatomic relationship between JAR and the mandibular canal revealed that in most cases the JAR was separated with the mandibular canal in the present study. Nascimento et al3 asserted that JAR is an image showing increased separation of the trabeculae in cancellous bone. Similar

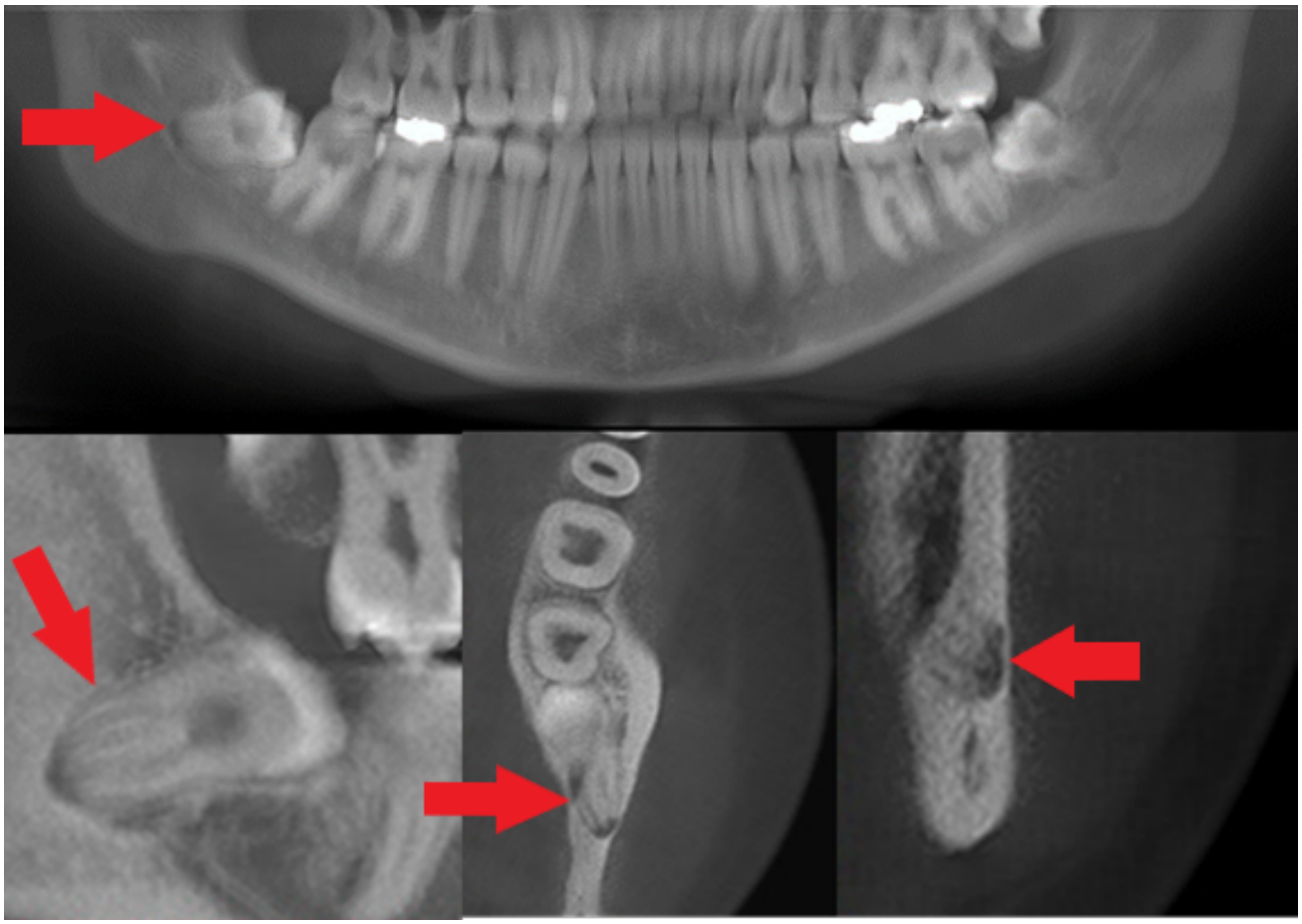

Figure 1. Multiplanar views of CBCT (Panoramic, sagittal, axial, coronal) show a juxta-apical radiolucency image (arrow), which appears as a well-circumscribed radiolucent area located laterally to the roots and continuously with the root apex of the third molar on the right side.

to this study, Yalçın and Artaş found no significant relation detected between JAR and the mandibular canal in their study.[7] Both study declares JAR does not need to be associated with the mandibular canal. The association between JAR and the mandibular canal is still unclear. Further studies are needed to clarify this issue. The status of the teeth was associated with presence of JAR in the present study, there was a significant difference for depth of impaction statistically. JAR was related to impacted mandibular molar teeth mostly (62,1%). Nascimento et al.[2] evaluated the depth of impaction for the mandibular third molar teeth. Similar to the present study, they found that JAR was detected in partially erupted or unerupted teeth in most cases (77%), however, this association was not statistically significant. The findings for unerupted, partially erupted and erupted mandibular molar teeth were 10%, 67,7%, 22,3% of the 130 cases of the JAR group, respectively. JAR can cause lingual nerve damage when positioned lingually as a result of lingual cortical plate thinning during third molar removal.[1] The current study showed that JAR was at lingual positional relation to mandibular cortical plate (46,3%). Similar to this study, Nascimento et al[9] examined the positional relation of JAR and the mandibular canal and concluded that JAR was significantly positioned lingual to the mandibular canal (59.6%). On the other hand, Kapila et al[6] and Yalçın and Artaş[7] reported that it was seen most often in buccal or superior positions to the mandibular canal. However, whether direct contact of the JAR with the nerve produces the same effect is unknown. It may be logical to consider that close proximity between the JAR and the mandibular canal, could produce a fragile area in the region of the mandibular canal that would leave the inferior alveolar nerve and lingual nerve more susceptible to injuries. However, to confirm this hypothesis, clinical trials should be planned containing CBCT imaging and postoperative follow-up. The limitations of this study were that the patients cannot be followed up because of the retrospective nature of the study and limited number of samples, so prospective CBCT studies will be planned with larger sample.

Conclusion

The results of the present study showed that JAR is not a rare imaging finding and third molars in female patients are more strongly associated with the presence of JAR. JAR has a stronger association with apical position of third molar. In most cases, JAR is detected along with impacted teeth and is separated from the mandibular canal. Additionally, cortical plates involvement related to JAR was associated with its identification on CBCT, in which lingual involvement increased its detection. Lingual position of JAR to mandibular cortical plate may increase the risk of nerve injury during removal of mandibular third molars when JAR is present. Three-dimensional evaluation allowed accurate JAR detection and comprehension of variables related to it, highlighting the value of the CBCT for this purpose. CBCT imaging for JAR assessment provides insights into the relationship of JAR with the mandibular canal and the mandibular cortical plates. Future studies that correlate the presence of JAR and its imaging characteristics with a higher incidence of postoperative complications are required.

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Author Contributions

S.C.: Designed the study; Reviewed the literature; Acquired, analysed, and interpreted the data; Statistical analyses; Wrote the manuscript; Approved the final manuscript

Authors declare that they have no conflict of interest.

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