

Assessment of Level of Knowledge Understood and Memorized of Panoramic Anatomical Landmarks among Dental Students in Benghazi, Libya

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Abstract

Background: Evaluation of skill competency and quality requirements of dental students plays an essential role in dental education. **Aim:** To investigate the level of knowledge of cranio-dentofacial anatomic structures observed on panoramic radiographs by 4th-year dental students and graduates in internship year at the Faculty of Dentistry, University of Benghazi. **Materials and Methods:** A total of 73 4th-year dental students and 92 interns attending the 2018/2019 academic year participated in this study to identify 24 landmarks on a traced panoramic radiograph. Descriptive statistics and Chi-square analyses were performed ($P < 5\%$). **Results:** The overall correct answer rate for 24 anatomical landmarks was 26.2% (± 0.23) among the 4th-year students and 29.68% (± 0.24) among interns. Significant differences were observed only between hard tissues and soft tissues/air layer. For both groups, Head of the condyle was the most identified (79.5% for the 4th-year and 71.7% for interns), while the middle nasal concha was the least recognized structure (100% incorrect answer). **Conclusions:** Both 4th-year students and interns had a similar level of knowledge in identifying anatomical structures shown on panoramic radiography. The teaching program should focus on familiarizing dental students with the unidentified anatomical structures on panoramic radiographs.

Keywords: Anatomical landmarks, dental students, panoramic radiograph, teaching program

INTRODUCTION

The main aim of dental schools worldwide is to yield an entry-level practicing dentist who has the potential to perform work and resolve encountered problems through critical thinking in a nonsupervised environment. The basis of a competent practitioner is the utilization of cognitive process that enables a dentist to identify relevant information in a patient presentation, take accurate decisions relying on the thoughtful and unbiased appraisal of possible treatment modalities, assess their outcome, and evaluate their own performance.^[1] A successful educational system should enable students to gain nonclinical, clinical, and personal capabilities and skills combined with knowledge of biomedical, behavioral, and basic dental courses.^[2] Furthermore, students should be competent in practicing evidence-based dentistry employing a problem-based methodology based on their acquired theoretical knowledge as well as their applied skills.^[2]

Several studies reported that the educational experience of dental students' basically has focused on the individualities of the student, academic environment, and curriculum structure.^[3-5] The efficiency of an educational and learning process and curriculum structure come to be recognized when student performance is systematically assessed. The continuous students' assessment and evaluation could clarify the aspects that require curriculum development of academic performance.^[6]

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How to cite this article: Elsheikhi FO, Betamar N, Bugaighis I. Assessment of level of knowledge understood and memorized of panoramic anatomical landmarks among dental students in Benghazi, Libya. Libyan Int Med Univ J 2021;6:69-74.

Received: 22-06-2021 **Accepted:** 03-08-2021

Published: 05-01-2022

Access this article online

Quick Response Code:



Website:
journal.limu.edu.ly

DOI:
10.4103/liuj.liuj_77_21

Dental radiography is one of the important topics to be taught to dental students among all dental specialties. Dental radiography is the art of recording two-dimensional images of three-dimensional craniofacial structures.^[7] According to the position of films, two main imaging methods are present; intra- and extra-oral. Panoramic radiography is considered as an extraoral radiography.^[7]

Panoramic radiography is used for screening the entire dentition for the presence or absence, position, level of tooth development, and general health of teeth and their supporting structures. It is also used in determining dental age and the assessment of the relationship of teeth to their skeletal bases in anteroposterior and transversal dimensions.^[7,8] Panoramic radiography is also important in providing significant technical, scientific, and legal data.^[9] The main advantages of panoramic radiography are the low dose of the required radiation exposure; it does not rely on patient cooperation. However, panoramic radiographs have several limitations including that; specific equipment is required for image acquisition, distortion, magnification, and overlapping of different structures.^[10] Accurate interpretation of panoramic radiography requires a good quality image,^[11] an understanding of the panoramic imaging principles,^[7,8,12] and a high level of craniofacial anatomical knowledge.^[7] Learning the interpretation of normal anatomical structures in panoramic radiography continues to be an essential part of the dental curriculum.^[12,13] Dental students at the Faculty of Dentistry, University of Benghazi acquire their education and knowledge about panoramic radiography and the process of identifying and recognizing the anatomical landmarks through lectures, tutorials, seminars, and clinical training sessions at different dental specialties during the 3rd-and 4th-year and throughout the internship training year. Students are required to distinguish anatomical structures as well as any pathological findings during their educational process. However, it has been noted that some of the anatomical structures are difficult to identify or memorize. Thus, it was important to evaluate the knowledge, awareness, and level of students' ability to identify or memorize the taught anatomical landmarks on panoramic radiographs and to determine the more challenging structures to recognize. Therefore, the current study was conducted aimed to assess and investigate the level of knowledge of panoramic radiographic anatomical landmarks understood and memorized by the 4th-year dental students and the newly graduates in the internship training year at the Faculty of Dentistry, University of Benghazi.

MATERIALS AND METHODS

This study was based on a written examination of anatomical landmarks on test-chart.^[8] The target groups were the 4th-year dental students and the interns who were newly graduated and attending the 2018–2019 academic year at the Faculty of Dentistry, University of Benghazi. The participants were invited to contribute to the study to identify and recognize

the marked anatomical structures on a traced panoramic radiograph [Figure 1]. A very clear panoramic radiograph was traced. Twenty-four anatomical landmarks were determined and indicated by numbers. Examination papers contained a traced panoramic radiograph and answer sheets to be answered with names of the indicated 24 anatomical landmarks were printed and distributed to all examinees. The duration of the examination was set to be 20 min. The anatomical landmarks were categorized into three regions; hard tissue, soft tissue/air layers, and ghost areas. The collected data were transferred to an excel file. Descriptive statistical analyses were performed. Chi-square test was used to compare correct answer rates between both groups using SPSS version 23.0, (SPSS, IBM, Armonk, NY, USA). The significance level was set at 5%.

RESULTS

A total number of 73 4th-year dental students (58 female; 79.5% and 15 male; 20.5%) in addition to 92 interns (80 females; 87.0% and 12 males; 13.0%) participated in the study. The mean value of the percentage of the overall correct answers (the 24 regions) was 26.2% (± 0.23) among the 4th-year students and 29.68% standard deviation ± 0.24 among the interns. Table 1 and Figure 2 display the mean percentage of the overall correct answers of the 24 anatomical landmarks for the 4th-year students and interns. Around two-thirds of each of the 4th-year students and interns were able to identify the following landmarks; condylar head (4th-year students at 79.5% and interns at 71.7%), infra mandibular canal (4th-year students at 74.0% and interns at 70.7%), and the mental foramen (4th-year students at 61.6% and interns at 66.3%). On the other hand, none of the cohorts could identify the middle nasal concha, and merely 1.4% of the 4th-year students recognized the middle nasal meatus. Similarly, inferior nasal concha was not recognized by any of the 4th-year students and identified only by 2.2% of the interns.

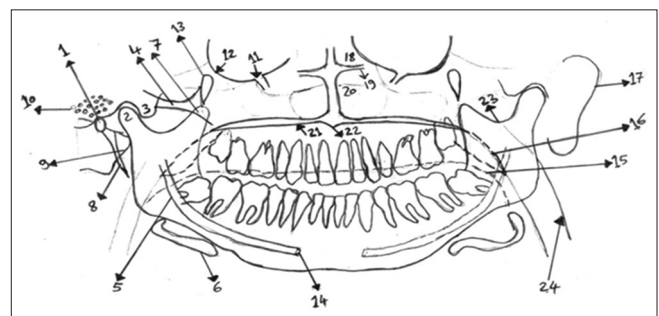


Figure 1: A traced panoramic radiograph used in the examination. The numbers in the figure represent the following anatomical landmarks: (1) External acoustic foramen, (2) Condylar head, (3) Articular eminence, (4) Zygomatic arch, (5) Mandibular canal, (6) Hyoid bone, (7) Coronoid process, (8) Styloid process, (9) Cervical vertebrae, (10) Mastoid air cells, (11) Infra-orbital foramen, (12) Infraorbital border, (13) Pterygopalatine fossa, (14) Mental foramen, (15) Dorsum of the tongue (Ghost image), (16) Soft palate, (17) Ear lobe, (18) Middle nasal concha, (19) Middle nasal meatus, (20) Inferior nasal concha, (21) Hard palate, (22) Anterior nasal spin, (23) Mandibular notch, (24) Posterior pharyngeal wall

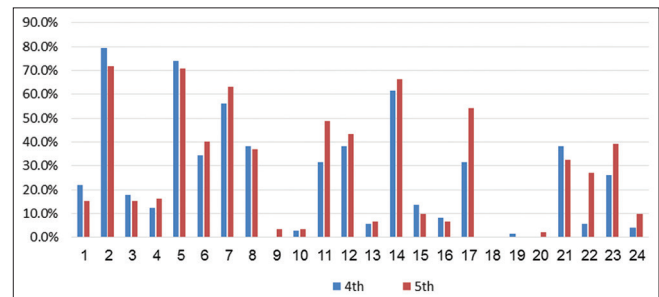
Table 1: The correct answer rates of the 24 regions for the 4th-year students and interns

	4 th year, <i>n</i> (%)	Interns, <i>n</i> (%)	<i>P</i>
1. External acoustic foramen			
0	57 (78.1)	78 (84.8)	0.268 (NS)
1	16 (21.9)	14 (15.2)	
2. Condyle			
0	15 (20.5)	26 (28.3)	0.255 (NS)
1	58 (79.5)	66 (71.7)	
3. Articular eminence			
0	60 (82.2)	78 (84.8)	0.655 (NS)
1	13 (17.8)	14 (15.2)	
4. Zygomatic arch			
0	64 (87.7)	77 (83.7)	0.472 (NS)
1	9 (12.3)	15 (16.3)	
5. Mandibular canal			
0	19 (26.0)	27 (29.3)	0.637 (NS)
1	54 (74.0)	65 (70.7)	
6. Hyoid bone			
0	48 (65.8)	55 (59.8)	0.432 (NS)
1	25 (34.2)	37 (40.2)	
7. Coronoid process			
0	32 (43.8)	34 (37.0)	0.370 (NS)
1	41 (56.2)	58 (63.0)	
8. Styloid process			
0	45 (61.6)	58 (63.0)	0.854 (NS)
1	28 (38.4)	34 (37.0)	
9. Cervical vertebrae			
0	73 (100.0)	89 (96.7)	0.119 (NS)
1	0	3 (3.3)	
10. Mastoid air cells (bone)			
0	71 (97.3)	89 (96.7)	0.846 (NS)
1	2 (2.7)	3 (3.3)	
11. Infraorbital foramen			
0	50 (68.5)	47 (51.1)	0.024*
1	23 (31.5)	45 (48.9)	
12. Infraorbital border			
0	45 (61.6)	52 (56.5)	0.507 (NS)
1	28 (38.4)	40 (43.5)	
13. Pterygopalatine fossa (ptergomax. fissure)			
0	69 (94.5)	86 (93.5)	0.780 (NS)
1	4 (5.5)	6 (6.5)	
14. Mental foramen			
0	28 (38.4)	31 (33.7)	0.535 (NS)
1	45 (61.6)	61 (66.3)	
15. Dorsum of tongue			
0	63 (86.3)	83 (90.2)	0.434 (NS)
1	10 (13.7)	9 (9.8)	
16. Soft palate			
0	67 (91.8)	86 (93.5)	0.677 (NS)
1	6 (8.2)	6 (6.5)	
17. Ear lobe			
0	50 (68.5)	42 (45.7)	0.003*
1	23 (31.5)	50 (54.3)	
18. Middle nasal concha			

*Contd...***Table 1: Contd...**

	4 th year, <i>n</i> (%)	Interns, <i>n</i> (%)	<i>P</i>
0	73 (100.0)	92 (100.0)	1.00 (NS)
19. Middle nasal meatus			
0	72 (98.6)	92 (100.0)	0.260 (NS)
1	1 (1.4)	0	
20. Inferior nasal concha			
0	73 (100.0)	90 (97.8)	0.205 (NS)
1	0	2 (2.2)	
21. Hard palate (nasopalatine line)			
0	45 (61.6)	62 (67.4)	0.442 (NS)
1	28 (38.4)	30 (32.6)	
22. Anterior nasal spine			
0	69 (94.5)	67 (72.8)	<0.001*
1	4 (5.5)	25 (27.2)	
23. Mandibular notch			
0	54 (74.0)	56 (60.9)	0.076 (NS)
1	19 (26.0)	36 (39.1)	
24. Posterior pharyngeal wall			
0	70 (95.9)	83 (90.2)	0.163 (NS)
1	3 (4.1)	9 (9.8)	

*Significant. 1: Correct answer, 0: Incorrect answer, $P \leq 0.05$. NS: Nonsignificant

**Figure 2:** Comparison between 4th-year and interns (5th) regarding the correct answers

Significant differences have been observed between both academic years in the answer of infraorbital foramen ($P = 0.024$). The accurate answer rate for 4th-year students was 31.5% and for the interns was 48.9%, while the inaccurate answers were 68.5% for 4th year and 51.1% for the interns. There was a highly significant difference between both years in identifying the ear lobe ($P = 0.003$), the correct answer rate was 31.5% for 4th-year students and 54.3% for interns, and the incorrect answer between both years was 68.5% for 4th-year and 45.7% for interns. Another high significant difference has been noticed in the anterior nasal spine ($P < 0.001$), in which the correct answer showed 5.5% for the 4th-year and 27.2% for interns, while the incorrect answer showed 94.5% and 72.8% for 4th-year and interns, respectively [Table 1]. Significant differences in the correct answer rate were only observed between hard tissues and soft tissues/air layers.

DISCUSSION

Panoramic radiography might be used along with a dental clinical examination to provide an efficient and overall view of the stomatognathic structures. Recognition of anatomical structures on panoramic radiographs is a critical skill that dental students must acquire throughout their academic education. This proficiency equips future dentists with a valuable mean to differentiate between normal and abnormal radiographic findings and therefore, enhance their diagnostic capacity.^[14]

There are substantial resources^[10-13,15] exploring panoramic radiography. However, studies exploring dental students' knowledge and capacity in identifying anatomical structures on those radiographs are sparse. Razmus *et al.*^[16] evaluated the whole knowledge of graduating American dental students of anatomical landmarks on panoramic radiographs without elaborating on individual anatomical structures level of recognition. Shintaku *et al.*^[14] observed a significant agreement of osteoporosis's diagnostic outcome among radiologists and their students. Maeda *et al.*^[8] undertook a similar investigation to the present study on Japanese dental students in two different academic years to determine easy or challenging landmarks to identify.

This study was undertaken for the undergraduate students in their final academic year and the newly graduated dentists. A traced paper was used instead of an actual radiograph to ensure standardization of clarity for all participants. The examinee was required to recognize the anatomical landmarks as hard tissues, soft tissues, and other overlapping structures. However, identifying overlapping anatomical structures on a traced copy is challenging. Besides, a traced copy lacks the information provided by the variation in density between the different anatomical structures in the original radiograph.

The academic training program mainly focuses on the chosen anatomical configurations; hard and soft tissues, air layers, and ghost images due to the high occurrence of abnormalities in those structures. However, including 24 regions might limit the participants' ability to identify the required landmarks. The included radiographic landmarks (24) were chosen simultaneously to adapt to the reasonable time designated for the examination (20 min).

In the present study, both groups were able to identify just over a third of the included landmarks with (27.9%); 4th-year 26.21%, interns 29.68%). In a similar study, Japanese students were able to recognize 53% of the required landmarks.^[8] The high tissue density and the apparent configuration of the condyle usually facilitate its recognition. This agrees with our study where majority of the participants were able to identify the condyle (75.6%). However, this ratio remains lower than the percentage of the Japanese students (97%) who successfully recognized the condyle.^[8] On the other hand, the results revealed that our students were more familiar with the mandibular canal (71.8%) than the Japanese students (17%).^[8]

This might be due to our students increased exposure to this landmark during the teaching classes in different departments.

Both groups in our study were not familiar with the nasal region structures; the middle nasal concha was not recognized by all the participants (100%), similarly to the identification of the middle nasal meatus (99.3%) and inferior nasal concha (98.9%). This outcome might indicate a shortage and limited exposure to these structures throughout their learning process. Maeda *et al.*,^[8] reported that their examinees mixed up the position of the landmarks in the nasal region, for example, their subjects confused middle nasal concha with middle nasal meatus, and inferior nasal concha instead of inferior nasal meatus leading to a moderately low average score rates.

In this study, a traced radiograph was used to overcome the overlapping produced from the superimposed anatomical structures. Some students had difficulties in identifying some landmarks due to a lack of density contrast. Therefore, it might be beneficial to add advanced devices such as tablets and mobile phone software to improve visibility and recognition of anatomical structures in the teaching and learning process. Tadinada *et al.*^[17] evaluated the visibility of the anatomical landmarks on tablets demonstrating 466 panoramic radiographic images. They concluded that for some landmarks the tablets offered improved clarity and could be used as educational aid in the field of radiology.

CONCLUSIONS

This study showed that both 4th-year and interns had a similar level of knowledge in identifying most of the anatomical structures shown on panoramic radiography. However, both groups need to improve their knowledge and skills before pursuing their dental career. Therefore, an effort should be applied during the teaching program on anatomical structures that were difficult to identify.

Acknowledgments

Great appreciation to the Orthodontic Department, University of Benghazi for the support and help.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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ملخص المقال باللغة العربية

تقييم مستوى المعرفة المفهومة وحفظ المعالم التشريحية البانورامية لدى طلاب طب الأسنان في بنغازي، ليبيا

المؤلفون

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الخلفية: يلعب تقييم الكفاءة والمهارة ومتطلبات الجودة لطلاب طب الأسنان دوراً أساسياً في تعليم طب الأسنان.

الهدف: التحقيق في مستوى المعرفة بالتركيبات التشريحية القحفية للأسنان والوجه على الصور الشعاعية البانورامية من قبل طلاب وطالبات السنة الرابعة في طب الأسنان وخريجي سنة الامتياز في كلية طب الأسنان، جامعة بنغازي.

المواد والطرق: شارك ما مجموعه 73 طالب طب أسنان من السنة الرابعة و92 متدرباً حضروا العام الدراسي 2019/2018 في هذه الدراسة لتحديد 24 معلماً على صورة شعاعية بانورامية تم تحديدها مسبقاً على الأشعة.

النتائج: بلغ معدل الإجابة الصحيحة على 24 معلماً تشريحياً 26.2% (± 0.23) بين طلاب السنة الرابعة و29.68% (± 0.24) بين المتدربين. لوحظت فروق ذات دلالة إحصائية فقط في التعرف بين الأنسجة الصلبة والأنسجة الرخوة/طبقة الهواء. بالنسبة لكلا المجموعتين، كان رأس اللقمة هو الأكثر تحديداً (79.5% للعام الرابع و71.7% للمتدربين)، بينما كانت محارة الأنف الوسطى أقل بنية معروفة (100% إجابة غير صحيحة).

الاستنتاجات: كان لدى كل من طلاب السنة الرابعة والمتدربين مستوى مماثل من المعرفة في تحديد الهياكل التشريحية الموضحة في التصوير الشعاعي البانورامي. يجب أن يركز برنامج التدريس على تعريف طلاب طب الأسنان بالتركيبات التشريحية غير المحددة في الصور الشعاعية البانورامية.

الكلمات المفتاحية: معالم تشريحية، طلاب طب أسنان، تصوير شعاعي بانورامي، برنامج تعليمي.