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Evaluation of Radiographic Interpretation Skills of Undergraduate Dental Students

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Abstract:- The usage of the dental radiographs is considered as one of the important methods in diagnosis of the dentofacial pathologies mostly fractures, dental caries, bone resorption, benign and malignant tumours [1]. This survey is conducted to assess the ability and knowledge of the undergraduates to interpret a dental radiograph. A questionnaire containing 20 questions pertaining to different types of dental radiographs like IOPA, OPG.TMJ radiographs and CT[2]. Around 100 undergraduates participated in the survey.

I. INTRODUCTION

Dental X-rays are considered as one of the most reliable and easy way of diagnosis and management of various dental conditions in Dentistry[1]. X- rays help in identifying the dental problems that cannot be diagnosed by chair side examination, i.e., interproximal caries can be easily identified by IOPA radiograph than in chair side examination. This is because the hard tissues like bones and teeth can absorb more radiation compared to the soft tissues like gums, cheeks etc. this creates a radiographic image which shows clear differentiation between all the tissues which in turn is used to identify dentofacial pathologies.

This survey is conducted among 100 Dental intern students to assess their radiographic interpretation skills. The participants are categorised into three groups as the current interns, students just entering internship and the interns who had completed recently. Based on this the analysis is done.

II. BACKGROUND

Dental X-rays are the foundation for confirmative diagnosis in dentistry. They play a very important role in treatment planning and localisation of dentofacial pathogenesis.

X-Rays were discovered in 1985 by Wilhelm Conrad Roentgen; they showed ultimate potential in the medical field when it came to diagnosis. Later Drotto Walkhoff took the first ever dental X-Ray[3][4].

➢ *Importance of dental rays:*

- A necessary component for diagnosis
- A necessary component for planning treatment
- To find many dental pathologies which would have been unidentified by clinical examination[4].

In order to identify the pathological changes in the dental radiograph one must know the normal anatomical landmarks and structures seen in the dental radiograph. The Survey is conducted among the Undergraduates who are pursuing their internship. The participants are divided into three groups collectively as undergraduates who are entering internship, current interns and undergraduates who completed their internship. This is done in order to assess the awareness among the different groups of interns to interpret dental radiographs and also their knowledge regarding different dental radiographs and the anatomical structures seen in the radiograph. The statistical analysis and the discussion of the survey is included.

III. AIM

The aim of the survey is to assess the knowledge of the Interns to interpret dental radiographs. Around 100 interns participated in the survey. The survey also concentrates on the knowledge of the interns when it comes to identification of the different dental landmarks seen in the radiograph and also about other types of radiographs used in dentistry and their indications. The participants are divided into different groups as Current interns, interns entering internship and interns who completed their internship. The discussion is also done by dividing the question into aptitude based and knowledge-based questions.

IV. MATERIALS AND METHODOLOGY

The survey is an online based survey. A questionnaire consisting of 20 multiple choice questions in google form is made and circulated among the interns. A total of hundred interns under different categories participated in the survey. The details from the responses are collected and statistical analysis for the data is calculated. Through this conclusion is formatted.

V. STATISTICS

A comparison study was conducted with three groups of interns- entering internship, current interns and passed out interns. p-value of the above-mentioned groups for each question was discussed separately and then compared.

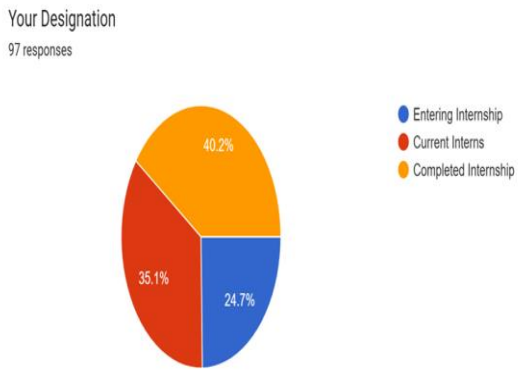

Fig 1:- Your Designation

VI. RESULT

A total of 100 responses were obtained in which 40 are undergraduates who completed their internship, 35 are undergoing internship and 25 are entering internship. The results are obtained through online mode using google forms. As expected, the responses were mixed leaning more towards the passed-out interns, who performed admirably with an approximate p value of 0.001 and even less followed by the undergoing and entering interns. The responses given the schedule of the individual were uneven however just enough for the appropriation of the expected results.

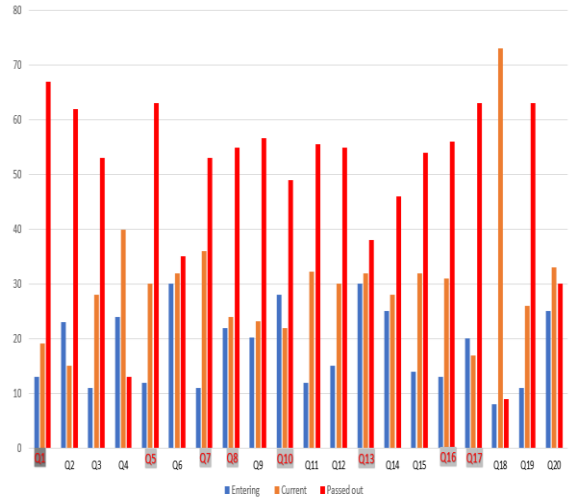

Fig 2:- Response

The highly significant p values of passed out interns (p=0.01-0.001)

➢ *Responses to Knowledge based questions*

Among the prepared questionnaires, the knowledge-based questions were interpreted equally by the three groups of interns. The best radiographic technique for analysing the root canal anatomy was correctly answered by both current and the passed-out interns with a p=0.00296. Maxillary anterior occlusal view and IOPA being the appropriate method for localization of impacted canine was correctly interpreted by the passed-out interns (p=0.04091).

The response towards the appearance of submandibular gland in sialogram showed a highly significant analysis among the passed out interns with p=0.001. The same question was correctly responded by the current interns as well with $p<0.05$.

Knowledge on the special appearances seen in orthopantogram was interpreted well by all the three groups of interns. But the statistical p value shows a marked significance value of p among the passed-out interns(p=0.00021) followed by the current interns(p=0.004).

Reverse Towne's view is efficiently used as the radiographic technique for interpreting the condylar and ramus fracture. Among the three groups of interns, Passed out interns only showed significant p value(p=0.00121). This showcases the appropriate knowledge on the identification technique in various clinical scenarios.

The radiographic image identification in case of malignant tumour helps in early diagnosis and for initiating treatment modalities. With a significant value of $p<0.05$ both the current as well as the passed-out interns interpreted the appropriate answer.

The presence of pulp stones in a radiographic image being a normal biological variant was answered by both the entering(p=0.017) and the passed-out interns(p=0.001).

Ewig's carcinoma shows onion peel appearance in radiographs. With a p value of p=0.023, only the passed-out interns correctly answered this question appropriately.

Salt and pepper appearance in the radiograph is shown in case of thalassemia. The question was correctly answered by all the three groups of interns. But a value of p=0.00012 shows high significance in case of passed out interns.

Knowledge on the special appearances on radiographs and easy identification of certain disorders. This develops with clinical experiences and skills. Soap bubble appearance seen in case of multiple myeloma was only answered by passed out interns with a high significant value(p=0.00213)

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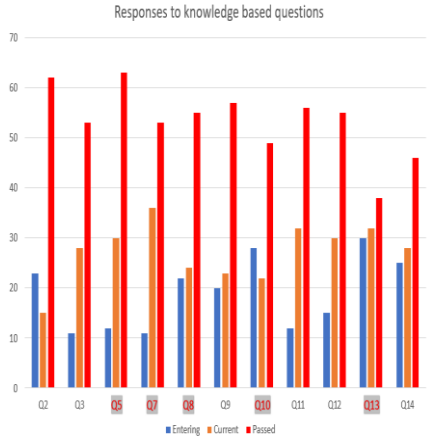

Fig 3:- Responces to Knowledge based Questions

➢ *Responses to attitude-based questions*

The response to attitude-based questions were also desirably answered by the three groups of interns. These questions were equally answered by current as well as passed out interns with a relatively good range of p value ($p<0.05$).

When asked about which radiograph will be of more use in identification of Mesiodens, the passed-out interns gave a more appropriate answer with a p value 0.00183 indicating a significant result. The best radiograph for the interpretation of the condyles bilaterally is Orthopantomogram which was correctly identified by the current interns9 p value=0.0364). When it comes to identification of the occluded salivary gland, sialography is considered to be more reliable. All of the participants are aware about this technique with p value<0.05. To Assess the Radiographic interpretation knowledge of the participants radiographs containing pathologies like condensing osteitis, sialolith and compound odontoma were shown. Presence of condensing osteitis is correctly identified by the passed-out interns with p value=0.00324, the current interns also gave a correct answer with a p value<0.05. When it comes to the identification of Sialolith identification the passed-out interns showed more appropriate responses with p value being significant. Identification of compound odontoma was majorly answered by the current interns (p value=0.043).

When given a case scenario of a patient with bifid ribs, mandibular prognathism and OPG with multiple radiolucencies the current and passed out interns gave a more significant diagnosis with the p value<0.05. Diagnosis of proximal caries is easier to identify in a bitewing radiograph. This is agreed by the current interns with a p value of 0.01235, the passed-out interns also gave an appropriate response of p value being less than 0.05

When questioned about the General Radiographic anatomical landmark all the participants were able to give the correct response with p value<0.05. Which interns show a strong knowledge on the anatomical landmarks in a radiograph amongst the interns.

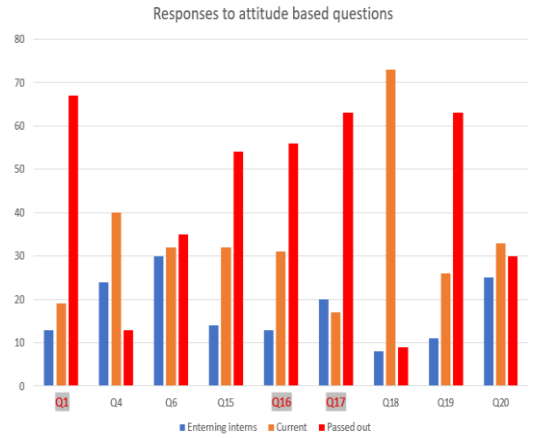

Fig 4:- Responses to Attitude Based Questions

Q.NO	QUESTION	ENTERING INTERNS%	CURRENT INTERNS%	PASSED OUT INTERNS%
2	Root canal anatomy and variation will be best known when one takes	32.50	53.15	76.00
3	In a patient with unerupted and impacted maxillary canine the following radiographic techniques will be ideal for localization	29.40	49.30	77.10
5	Sialogram of Submandibular salivary gland appears as	44.17	59.50	80.00
7	Ghost like shadow is seen in	56.15	53.60	52.45
8	Best radiographic view for condylar and ramus fracture	23.16	19.10	84.00

9	Radiographic image of a malignant tumour is	26.10	61.18	73.35
10	The presence of pulp stones on the radiograph of a tooth indicates the presence of	60.00	24.34	83.51
11	Onion peel appearance on radiograph is seen in	15.17	25.62	66.00
12	Multiple radio opacities are seen in	47.30	62.00	84.10
13	Salt and pepper appearance is seen in intraoral periapical radiograph of	61.50	70.11	90.00
14	Soap bubble appearance is seen in	24.12	43.50	69.14

Table 1 Responses To Knowledge Based Questions

Q.NO	QUESTION	ENTERING INTERNS	CURRENT INTERNS	PASSED OUT INTERNS
1	Best X-ray for mesiodens identification is	37.11	57.00	89.15
4	The best radiographic interpretation for bilateral condylar view of TMJ is	23.00	65.71	34.52
6	Occluded submandibular salivary duct can be best observed by	59.61	61.30	62.35
15	Identify the condition	47.90	56.55	73.71
16	Identify the pathology given below	49.00	47.14	86.00
17	A mandibular prognathism patient visited the clinic with bifid ribs along with the following OPG with multiple radiolucencies. The diagnosis is	41.32	70.00	81.17
18	Identify the condition	13.10	54.00	34.12
19	Radiographic diagnosis of proximal caries is best done by	11.00	57.71	60.00
20	Identify the structure	77.51	80.15	96.00

Table 2 Responses To Attitude Based Questions

Majority of the questions indicated the p value to be significant leaning more towards the passed-out interns as demonstrated in questions 1,2,3,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20

However even split was seen in questions 4 and 18.

Strangely some questions were answered better by the undergoing interns- 3,4,18, however the margin wasn't huge.

VII. DISCUSSION

➢ *Attitude based questions discussion:*

Awareness on evaluation of radiographic interpretation skills were conducted among the undergraduates. The questionnaire contains questions from various categories. It varies from angulation techniques, radiographic structures, various special radiographic appearances of various systemic conditions.

Supernumerary teeth are one of the most common developmental anomalies seen. It is very crucial to diagnose and interpret the structures so as to carry out the necessary treatment procedures[5]. Occlusal and panoramic radiographs are the most commonly used radiographic techniques for the diagnostic procedure. The current and the passed-out interns had clear ideas on this concept, whereas the current interns failed to recognize the correct radiographic procedure. This can be improved through educating them about the various radiographic techniques[5].

Temporomandibular joint pathologies or dysfunctions are very commonly seen in clinical practices. The diagnostic technique of choice is magnetic resonance. The current interns exhibited more skill in identifying the technique of interpretation for bicondylar view. The entering interns must be tutored using various available radiographs by tracing it and understanding the important landmarks.

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The current and the passed-out interns showed immense identification ability of salivary gland abnormalities. Understanding the basic difference between a sialogram and sialography must be understood. Any abnormality in salivary glands can be analysed through the technique of sialography. All the groups of interns in which the survey was conducted were precise about this technique.

Condensing osteitis is an inflammatory disease of the bone seen peri apically. This can be caused by an underlying tooth infection mostly. It appears as a round radiopaque structure seen at the periapical region of the tooth root caused due to increased bone formation. When given an IOPA containing this characteristic appearance the students who completed their internship and the current interns were able to identify the condition which shows their increased exposure to the clinical practise unlike the students entering internship. Similarly, when asked to identify a given pathology in the occlusal view with radiolucency in the lingual area only the students who completed their internship gave a more appropriate answer.

When given a clinical scenario where a patient with bifid ribs, mandibular prognathism[6] approaches the practitioner with a OPG where multiple radiolucencies can be identified many of the current interns and students who completed their internship were able to give an appropriate answer which is cleidocranial dysplasia[6] which has all the above mentioned clinical appearance[7], this verifies the dexterity to operate both their applied and acquired knowledge in contrast to the students entering internshipship. Similar response is seen when asked about the more relevant radiograph used to identify proximal caries which is bitewing radiograph.

An intraoral periapical radiograph in which multiple tooth-like radiolucencies are observed is attached in the questionnaire, when asked to identify the pathology the interns and students who completed their internship gave a veracious answer, the answer being compound odontoma.

When asked to identify a basic anatomical landmark in a given IOPA all the interns were able to identify it. This shows a strong knowledge on the basic radiographic anatomical structures among them.

- *Knowledge based questions discussion:*

Root canal treatment is a key treatment protocol in dentistry. The first step of this procedure starts with radiographic analysis of the required tooth. The mesial and distal angulation intraoral periapical radiograph correctly interprets the root canal anatomy. Passed out interns precisely interpreted the technique. The inability of the entering interns on the technique selection can be improved through more clinical exposure.

Impacted teeth must be diagnosed and treated as soon as possible. This improves the eruption of teeth and prevents further abnormalities. Canines being one of the most frequent sites of impaction, the students must be thorough about the radiographic technique. Though an intraoral periapical radiograph helps in the identification, a maxillary anterior view aids in its exact positioning. The current and the passed-out interns were specific about the technique, which shows the clinical experience.

All radiographic techniques exhibit certain special features. Understanding these structures helps in easy identification. Appearance of ghost-like shadows is a characteristic feature of OPG. With a p value less than 0.05 for all the three groups of interns, the result shows high significance. A similar significance rate is seen when asked to identify the basic anatomical structure seen in the dental radiograph.

The basic interpretation of any fracture is done through radiographs. Appropriate knowledge about various views in radiographic techniques is necessary to acknowledge certain structures. The best radiographic technique used for interpreting condylar and ramus fracture is Reverse Towne's view. Only the passed-out interns were able to analyse this proper view. The rest must be educated through proper radiographic technique classes.

The special appearances of certain radiographs interpret the underlying abnormalities. Understanding these basic concepts helps in the appropriate identification of abnormalities present, which eases and necessitates the required treatment modalities. The passed-out interns and the current interns exhibited exceptional knowledge in regards to identification of malignant tumours special appearance i.e., the sunburst appearance.

The Pulp stone appears as a round radiolucent structure in the pulp chamber, this is due to the degeneration of the pulp and calcification of it. It can be due to various causes like orthodontic tooth movement. Marfan's syndrome etc. The students entering internship and the completed interns told the answer that the pulp stone is a type of pathology found in the pulp chamber. Whereas the current interns were not familiar with it.

Onion peel appearance is mostly seen in osteosarcoma, Ewing sarcoma and Langerhans cell histiocytosis. These appear as radiolucent areas with multiple layers of dense bone formation. The radiolucent areas indicate the tumours, thus giving its characteristic appearance. The undergraduates who completed the internship are able to give the appropriate answer unlike the students entering internship and current interns. This may be due to the lack of practical and clinical exposure of such patients.

Knowledge about the characteristic appearance of the dentofacial pathologies is considered as one of the important concerns when it comes to differential diagnosis and to make diagnosis much easier. When asked about the pathology related with salt and pepper appearance of the jaw, astonishingly the undergraduate interns under all categories were able to give the correct answer i.e., thalassemia. But when asked about the soap bubble appearance only the students who completed their internship were able to answer the question precisely, which implies their increased

exposure and practical knowledge on radiographic interpretations. When questioned regarding multiple radiolucencies a majority of the current interns and students who completed internship were able to give a more precise answer unlike the students entering internship.

VIII. CONCLUSION

As was assumed prior to the beginning of the study proved to be an accurate hypothesis it was found that the "accuracy of diagnosis" via radiographic imaging techniques was found to be highest in the passed-out interns.

As expected, the current and those starting internship followed suit, this can be explained by the fact that the former received much better clinical experience than the later. One may draw a vital contrast between those clinically exposed and those who weren't, thus we conclude by making the obvious yet now mathematically backed conclusion of the importance of clinical exposure.

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