

Efficacy of Panoramic Radiography Versus Clinical Evaluation as a Diagnostic Tool - A Cross Sectional Study

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Abstract

Background and Objectives: The commitment of the dental profession in delivering the highest quality of care to each of its individual patients and applying advancements in technology and science has been continually improving the oral health status of the population globally. Radiographs can help the dental practitioner evaluate and definitively diagnose many oral diseases, disorders and conditions.

Hence the present study aims to compare the clinical features and findings with the panoramic radiographic features and the frequency to detect various occult findings which were undetected clinically.

Methodology: A total of 130 patients above 10 years of age inclusive of both genders were taken as sample size. After an informed consent from all the study subjects and institutional ethical committee clearance, a thorough clinical examination was carried out under optimal illumination and recorded on a pre designed Performa.

This was followed by a panoramic radiographic screening.

The pathologies which were taken into consideration, clinically (C) and radiologically (R) to check for their association in the study included:

- Dental caries (C₁ and R₁)
- Periodontal bone loss (C₂ and R₂)
- Condylar changes (C₃ and R₃)
- Any occult/incidental findings (C₄ and R₄)

The data was analyzed using Chi-Square test.

Results: The association in above mentioned 4 groups was found to be 99% (significant p < 0.05), 94% (significant p = 0.44), 84% (significant p = 0.32) and 11% (p > 0.05 - statistically insignificant) respectively.

Conclusion: Radiographs have been an important aid in guiding the dental practitioner evaluate and definitively diagnose many oral diseases and conditions. The use of panoramic radiography as an additive tool to the clinical examination in oral evaluation would enhance the global oral health thereby proving to be an essential diagnostic tool.

Keywords: Radiographs; Diagnostic Tool; X-Rays

Introduction

“The eyes see what the mind knows”. Is this proverb apt otherwise? In diseases of the oro-facial region, clinical evaluation was indeed a great tool to detect, understand and treat. In fact this was the only means that existed for a very longtime. But in the present days due to limitless emerging technologies, newer methods of disease detection are available. Most important among them has been the invention and use of x-rays which is a form of ionizing radiation. This magical ray has indeed developed over the years by leaps and bounds and has almost taken up a lion share among the many investigative modalities [1,2]. In the field of dentistry and investigations of oro-facial diseases X-rays play a major role. Both the conventional and digital forms of this investigation are being used routinely in screening, diagnostic and therapeutic procedures. Among them the most used screening x-ray tool is Orthopantomogram (OPG), used to analyze the overall status of the teeth and their associated structures in maxilla and mandible.

But as the saying goes, it needs more to gain more, human race has had to pay more in terms of detrimental effects of radiation and health hazards at large. Now in the present scenario we are reverting back to question whether x-rays are absolutely mandatory or is clinical evaluation enough in diagnosing the same. The clinical oral cavity examination includes, in addition to assessment of the soft tissues, the condition of the teeth, the restorative and prosthetic treatment of the teeth, as well as sensitivity testing and determination of the periodontal situation [3,4].

Hence the present study is conceptualized and designed to scientifically study the efficacy of OPG and clinical evaluation in terms of accuracy as a diagnostic tool.

Hypothesis

- **H₀**: Null Hypothesis- Both clinical evaluation and panoramic radiography are equally efficient as a diagnostic tool in dental evaluation.
- **H₁**: Alternate Hypothesis- Either clinical evaluation is better compared to panoramic radiography or vice versa is true in terms of efficacy as a diagnostic tool in dental evaluation.

Aims and Objectives of the Study

1. To determine efficacy of panoramic radiography as a screening tool in dental evaluation.

2. To determine efficacy of clinical evaluation as a screening tool in dental evaluation.
3. To compare and evaluate the efficacy of panoramic radiography and clinical examination as a tool in dental evaluation.

Materials and Methodology

Armamentarium (Materials Used)

- Sterile disposable gloves
- Sterile disposable masks
- Mouth mirrors
- Dental probes (Straight probe and Williams graduated probe)
- Disposable glasses
- Digital Panoramic System (ROTOGRAPH EVO D).

Methodology

Study sample included subjects visiting the Department of Oral Medicine and Radiology, aged above 10 years, comprising of both the genders. A total of 130 patients were taken as sample size.

After the institutional ethical committee clearance and an informed consent from all the study subjects, a thorough clinical examination was carried out under optimal illumination using the above mentioned armamentarium and a brief case history was recorded. The subjects' demographic data was entered in a pre designed proforma which included the age, gender, clinical signs, symptoms and the radiological assessment on a panoramic radiograph.

The subjects of the study were examined according to the protocol for general examination of the intra and extra oral features. The details about the drug history, past medical history comprising of any underlying systemic condition like diabetes, hypertension, cardiovascular or respiratory disease etc. were recorded.

This was followed by a panoramic radiographic screening. The digital panoramic radiographs were taken using a ROTOGRAPH EVO D with CCD sensors, operated at 60 to 80kVp and 6 to 10 mA with an exposure cycle of 13 seconds as recommended by the manufacturer.

The pathologies which were taken into consideration, clinically (C) and radiologically (R) in the study include:

- Dental caries (C₁ and R₁).
- Periodontal bone loss (C₂ and R₂).

- Condylar changes like erosion, flattening etc. (C_3 and R_3).
- Any occult/incidental findings which could not be assessed clinically (C_4 and R_4).

These pathologies were checked for each patient, both clinically as well as on the panoramic radiograph and charted on the designed proforma.

The relationship and association between the clinical and radiological findings were tabulated and then correlated. The data was analyzed using Chi-Square test.

Results

A total of 130 panoramic radiographs were evaluated. Out of these, association between the clinical and the radiological findings i.e., C_1 and R_1 was calculated and found to be significant ($p < 0.05$) statistically. This significance can be attributed to the good agreement (99%) between C_1 and R_1 on caries detection.

94% agreement was shown between the periodontal status clinically and radiographically i.e., C_2 and R_2 . This value too was significant ($p = 0.44$) statistically.

The agreement between the clinical examination of the temporomandibular joints (C_3) and the panoramic assessment of the condyle (R_3) in terms of erosion, flattening etc. was shown to be 84% which was statistically significant with a p value of 0.32.

In the fourth category i.e. in the groups C_4 (no findings detected clinically) and R_4 (incidental or occult findings on the panoramic radiograph), no agreement or association was found between the 2 groups. This value was however statistically insignificant ($p > 0.05$).

Entities	Association
C_1 and R_1 (Dental Caries)	99%
C_2 and R_2 (Periodontal Status)	94%
C_3 and R_3 (TMJ Evaluation)	84%
C_4 and R_4 (Occult Findings)	No Association

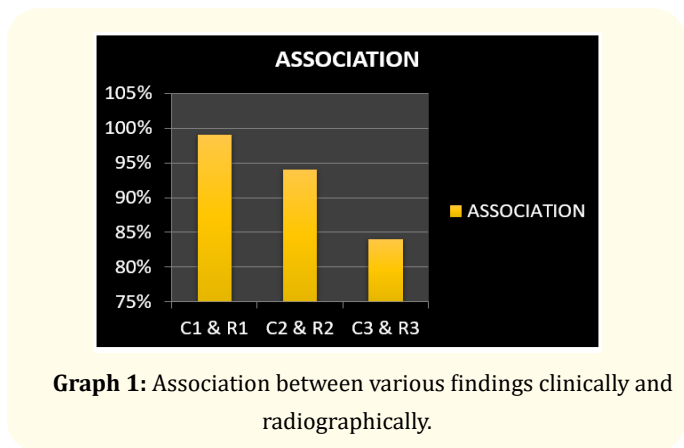
Table 1: Association between various findings clinically and radiographically.

Discussion

Panoramic radiographs are being used since ages in order to determine a graphics of the dental veolar complex the major advantage being reduced radiation exposure as compared to the full mouth intraoral set of radiographs. Panoramic radiography is an extraoral procedure which images the entire maxillomandibular component on one particular film [5,6]. Since its usage in general dental practice, panoramic radiography has been a reliable and an essential diagnostic tool. Panoramic radiography has been used routinely for evaluation of patients at various institutions and private dental clinics as it allows examination of the entire dentoalveolar complex, temporo mandibular joints, and adjacent structures [7,8].

Today, in the era of green dentistry echoing radiation protection, screen- film combination systems of intensifying screens have been accepted in radiographic examinations, especially the extraoral radiography. The obstacle has been that intensifying screen has not been able to gain uniform acceptance in oral radiology. The faster the speed of the screen, the reduced is the radiation dosage to the patient but unfortunately lesser is the sharpness of the final image. However, most dental extraoral diagnostic imaging can be carried out with screen- film combinations having enhanced speed. In all aspects of radiography, digital images have become the new way of exhibiting radiographic data to the clinicians and the physicians. This is the reason why digital radiography is preferred over conventional imaging [9,10].

Digital radiographs can be obtained either by using sensors in the form of phosphor storage plates or charge-coupled devices (CCD). Numerous studies have demonstrated that digital panoramic radiographs are of compliable diagnostic value. Apart from these numerous advantages of the panoramic radiography in context of arriving at the diagnosis and the formulation of the treatment plan, there has always been a debate in the literatures related to its com-



Graph 1: Association between various findings clinically and radiographically.

parison with the clinical examination of the oral tissues in terms of specificity, sensitivity, efficacy and accuracy [11-15].

There are few eminent researchers like William Scarfe, Neill Serman and Jonathan Ekermann who have conducted studies and concluded that the clinical examination, by far, holds an upper edge in arriving at the actual diagnosis [15,16]. Adversely, few of them have also hypothesized in favour of the panoramic radiography as better adjunctive diagnostic tool compared to the clinical evaluation alone [16,17].

In diagnosing the diseases of the periodontium, radiograph has been playing an important role since numerous critical information involving the bone level, periodontal ligament, crestal bone height and crown-root ratio cannot be detected through clinical examination. Shin., *et al.* reported panoramic examination to be better in terms of detection rate of 31.9% for periodontal diseases compared to the clinical examination. Ann., *et al.* documented 62.6% of calculi deposition in screening panoramic radiographs, which was greater than that of clinical examinations by approximately 7.4% [18-25].

An., *et al.* showed that abnormal conditions perceived by panoramic examination which had not been discovered on clinical examination were; 24.2% of dental caries, 17.4% of periapical lesions, 7.4% of calculi deposition, 5.3% of retained root, and 15.3% of third molar impaction [15]. They termed these findings as "incidental" or "occult" and concluded the use of panoramic radiography as an adjunct to the clinical examination and might be a valuable screening technique [26-30].

In our study too, no difference has been elicited between clinical and x-ray (panoramic) findings. At the same time, DPR findings were superior to clinical findings in context of the incidental findings in 11 cases that was identified as an idiopathic osteosclerosis. This however was insignificant when a large scale of population was taken into consideration. Therefore, it can be concluded that the Digital Panoramic Radiograph gives the clinician no additional gain in information in the normal scenario [30-32].

Therefore, we can say that our study is in accordance with the alternate hypothesis (H_1), thus emphasizing the edge which clinical evaluation has over panoramic radiography as a diagnostic tool in oral examination and evaluation.

Conclusion

The commitment of the dental profession in delivering the highest quality of care to each of its individual patients and applying advancements in technology and science to continuously improving the oral health status of the population has gained a wide range of appreciation worldwide. Clinical examination, which is based on a planned and appropriately designed case history performance, has been the most widely relied and trusted modality in order to assess the patients' signs and symptoms. In this regard, the various dental radiographs, have always added to the clarity in understanding of the disease or disorder and thus formulating a better treatment plan based on accurate diagnosis.

The dental clinician, knowing the patient's case history and vulnerability to oral disease, is in the best position to make this conclusion and assumption in the interest of each patient. Panoramic radiography is one such part of routine practice of dentists which due to its operation simplicity, low radiation dose, low cost, wide examined area and the ability to detect additional findings that it is widely used today.

Although panoramic radiography is found to be an essential and an effective adjunct and people show enhanced desire towards it for oral examination, taking panoramic radiography in annual dental examination holds a high risk of radiation exposure which goes against the principle of "As Low As Reasonably Achievable (ALARA)".

However, further investigations for selection criteria and quality management program of panoramic radiography in screening oral examination are required.

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