

Diagnostic Value of Panoramic Radiography in Completely Edentulous Patients

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Abstract

Panoramic radiograph is been used as a routine diagnostic procedure for all patients need restorative treatment. For removable complete denture's patient the benefit of this step is questionable. The aim of this study was to analyze the significance of the 'routine' use of digital panoramic radiography before conventional treatment in asymptomatic edentulous patients.

In this retrospective study, 229 digital panoramic radiographs of completely edentulous patients requesting removable complete dentures were interpreted by a prosthodontist, oral histologist, maxillo-oral surgeon and, oral radiologist. Ten patients were excluded. The following clinically radiographic findings were construed: remaining roots, impacted teeth, radiopacity, radiolucency and mental foramina positioned close to or at the crest of the residual alveolar ridge.

Forty-four radiographic observations were found, most of them were impacted teeth (eleven), 6 remaining roots, 8 radiopacity, 2 radiolucency and 4 patients with mental foramen on the crest of the ridge. Only 31 (14%) of the examined films had positive findings, 2 of which required surgical treatment before treatment with conventional removable prostheses, while the rest of the findings have no impact on the treatment plane.

These results minimize the importance of performing routine panoramic examinations of edentulous patients to detect radiographic findings that may negatively affect treatment with completely removable dental prostheses. A thorough history must be obtained, and a careful clinical examination must be performed for diagnosis, a periapical radiograph can be taken in case of any doubt of abnormalities.

This study discourage exposing the fully edentulous patients for panoramic radiograph as the results show minimum positive findings that affect the treatment plane.

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Introduction

The best complete dentures can be successful if they are placed on a good foundation and supporting tissues that are free from pathoses and abnormalities.¹ Visual and tactile examinations of the mouth cannot provide complete information regarding submucosal conditions. Panoramic dental radiography provides reasonable diagnostic information regarding jaw size, roots, impacted teeth, superficial position of the mental foramen and

other possible abnormalities that may not be detectable by intra-oral examination alone.^{1,2}

Although digital panoramic radiography reduces three-dimensional oral tissues to two-dimensional images, it has the advantages of delivering a single low dose of radiation to both jaws in a very short time, a decreased incidence of technical or processing errors that can arise with analogue radiography, and less radiation exposure without a reduction in diagnostic quality.³ Nevertheless, X-ray exposure involves risk, so the diagnostic benefits of such examinations should be weighed against the potential harm of the exposure.^{4,5}

The American Dental Association, supported by European standards, recommend not exposing a newly edentulous patient to unnecessary X-ray radiation unless signs and symptoms demand a radiographic examination.

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In the past, there was agreement regarding the pretreatment panoramic or full-mouth intraoral radiographic examination of newly edentulous adult patients to exclude any abnormalities, particularly the majority of these patients are at an advanced age and at high risk for developing oral disease.⁶ Furthermore, radiographic examinations show anatomic considerations that could influence denture construction, such as the location of the mental foramen.⁷ Some studies have emphasized the great diagnostic value of routine radiographic examinations for patients before treatment with removable complete dentures.⁷⁻¹⁶ This view was supported by the high percentages of positive radiographical findings (PRFs), and by the minimal rate of fatal malignancy of 0.21 - 1.9 per million panoramic exposures.¹⁷ Other studies have recommended radiographic examination for patients seeking new dentures only and not for individuals seeking replacement dentures.¹⁸

Moreover, many have underscored and criticized the importance of performing panoramic radiography before the construction of complete dentures because of the radiation hazards, limitations in detecting all abnormalities, minimal impact on the prosthodontic and surgical treatment plan.¹⁹⁻²⁴ in addition to unnecessary risk of surgical producers.²⁵

The objective of this study was to identify findings on digital panoramic radiographs of asymptomatic edentulous patients who attended the University of Ajman and to determine whether the radiographs affected the treatment plan before complete denture construction.

The null hypothesis was that the diagnostic panoramic radiographs do not reveal significant findings that affect the plan of treatment with removable complete dentures.

Materials and methods

Ethical approval

This study after obtaining ethical approval (F-H-17-06-05) from the University of Ajman research committee.

Study design and setting

This retrospective study was conducted with no preselection of patients; 219 pretreatment diagnostic digital panoramic radiographs of edentulous patients were randomly selected from radiographs obtained between September 2013 and December 2018.

A GX DP-700 Panoramic X-ray machine (KaVo) was used at 66 kV for 16 seconds and 35-mGy cm. VixWin Platinum software was used. The planned purpose of the screening radiograph was presumed to be a visualization of the edentulous arches to aid in complete denture fabrication. Included radiographs were evaluated under reduced ambient lighting on a medical-grade diagnostic grey-scale monitor, following viewing recommendations.²⁶

The inclusion criteria for patient selection were asymptomatic patients who attended the Restorative Department of Ajman University, were aged between 40 and 78 years and completely edentulous and sought new removable dentures, with or without old dentures. The exclusion criteria were the presence of clinical crowns or implants, poor radiograph quality or superimposition errors, and disagreement in the interpretation of the radiographic findings.

The investigators first compared their individual interpretations of 30 randomly selected radiographs, which were then re-checked by oral radiologists to measure the inter-rater reliability. Recorded PRFs on the digital panoramic radiographs were framed in five categories: impacted teeth, remaining root fragments, radiopacity, radiolucency, and the position of mental foramen at or near the crest of the alveolar bone. An oral maxillofacial surgeon was consulted to determine the treatment required for each finding.

Descriptive statistics were used to analyze the data. Each finding was categorized according to the type, location, and treatment required. Maxillary sinus pneumatization and stylohyoid ligament calcification were not reported in this study because they were frequently recorded in the edentulous patients and did not affect the treatment outcome.

Results

Two hundred twenty-nine digital panoramic radiographs were included in this study.

Ten panoramic radiographs were excluded (8 radiographs had superimposition errors, and the remaining 2 showed a partially erupted third molar and remaining root).

There were 133 radiographs from male patients and 86 radiographs from female patients.

Forty-four PRFs were observed in 31 (14%) patients, 16 (7%) of whom were males, and 15 (7%) of whom were females. The frequency and percentage of radiographic findings in the patients and the number of these radiographic findings that required treatment before construction of conventional removable prostheses are shown in Table 1.

Radiographic finding	Panoramic radiographs with PRFs, n	Frequency %	Total PRFs, n	Frequency %	Treatment required before treatment with removable prostheses (n)	Frequency %
Impacted tooth	11	5	14	6	3	1
Remaining root	6	3	6	3	0	0
Radiopacity	8	4	13	6	0	0
Radiolucency	2	1	2	1	2	1
Mental foramen on the crest of the ridge	4	2	8	4	0	0

Table 1. Frequency and percentage of radiographic findings in patients and the number of radiographic findings that required treatment prior to treatment with conventional removable prostheses.



Figure 1. Panoramic image showing multiple findings.



Figure 2. Panoramic image showing remaining root on mandibular left side.

Fourteenth impacted teeth (6%) were detected on 11 of the films (5%), and 3 radiographs showed multiple findings (Fig. 1). One radiograph showed 3 impacted premolars: one maxillary on each side and one mandibular on the right side. Another radiographs showed 3 impacted canines, with one on the maxillary left and right sides and one on the mandibular right side. The remaining 8 radiographs revealed

impacted third molars, 4 maxillary and 4 mandibular molars, distributed equally on both sides, with one of the left mandibular molars exhibiting a cystic lesion. Remaining roots were detected on 6 of the films (3%); all of the mandibular remaining roots were located behind the mental foramen (Fig. 2), 2 of which were close to the ascending mandible. The maxillary remaining roots were located on the maxillary tuberosity, and surgical intervention was not required in any of these cases. Thirteen sites of radiopacity (6%) were detected on 8 of the films (4%). In 4 patients (2%), both mental foramina were at or near the crest of the residual ridge, and 2 sites of radiolucency that required surgical intervention were detected on two panoramic radiographs, one of which was associated with an impacted third molar.

Discussion

The results of the current study reveal that the evidence for the claim that edentulous ridges that may look healthy are likely to have an underlying disease is weak.

The percentage of positive findings recorded was 14% (n=31), and in most cases, these findings had no influence on the treatment plan. Only 1% (n=2) of the findings had an impact on the treatment plan; in both of these cases, there was a site of radiolucency on the mandible, located between the midline and left mental foramen in one case and associated with an impacted mandibular left third molar in the other case.

Out of the 14 impacted teeth found, 12 required no surgical extraction, as they were fully embedded inside the bone with no noticeable pathological changes, and their removal might have caused unnecessary vertical bone loss, which could affect denture stability. One mandibular left impacted third molar was indicated for surgical removal because it was associated with a cystic lesion. While one of the right third molars was very close to the inferior dental nerve, the surgeon advised against removal as it might have endangered the inferior dental nerve.

Six of the findings were retained roots, all of which were surrounded by healthy bone; the oral surgeon recommended leaving them undisturbed with periodic observation.³

Mental foramina positioned close to or at the crest of the ridge were found in 4 cases, all of which were bilateral, and treatment was required only if denture relief was needed. Nine sites of radiopacity were discovered at different locations; one was diagnosed as a foreign body located above the right mental foramen and could have been an amalgam fragment, whereas the other 8 were identified as a dense bone that was considered normal and did not require treatment. The percentage of abnormalities found in this study was in agreement with those reported by other studies, which discouraged routine pretreatment radiography.^{2, 18, 21-24}

The range of the percentage of PRFs in those studies was from 68.3% and 0.33%, and between 34% and 0% of these findings had an impact on prosthetic or surgical treatment. Some studies reported a higher percentage of positive findings that still had a minimum impact on the treatment plan or denture fabrication.^{2, 18}

The higher number of findings obtained reported by some of these studies may be because they included findings not included in our study, such as calcified carotid artery atheromas,² maxillary sinus pneumatization, calcified stylohyoid ligaments, and lymph node calcification.¹⁸ We excluded these abnormalities because we believe that these findings will not alter the treatment plan. Additionally, we found fewer retained roots, which may be because of improvements in extraction procedures and the use of radiographic modalities before and after extraction.

A few studies have emphasized the necessity of panoramic analysis as part of the diagnostic process. Jindal et al.⁷ suggested routine panoramic radiographic examinations based on the high number of findings, i.e., with findings in 32% of 525 cases. The most frequent finding was retained root fragments in 16.4% of cases (n=86), and they recommended the removal of all of these teeth regardless of the pathological condition.⁷

Keur¹⁰ and Keur et al.⁹ reported a positive finding rate of 34%, and they considered all of the findings to impact the treatment plan because all patients with unerupted teeth or retained roots were "referred" to the oral surgeon despite the situation.

Sumer et al.¹¹ and Dias and Jiffry¹³ reported rates of 47.6% and 20%, respectively, but they did not consider the influence of these

findings on the use of dentures or the occurrence of surgical removal.

Conclusions

The diagnostic value of panoramic radiography in edentulous patients is questionable; while the ADA guidelines and European standards for radiographic examinations in edentulous patients restrict the old justification for routine panoramic radiography, many dental schools still consider it an essential part of complete denture pretreatment investigations.

Within the limitations of this study, routine diagnostic pantographic examinations of patients requesting conventional complete dentures is discouraged for two reasons: the first is that the rate of positive findings is low; the second is because these findings have a minimum impact on denture construction. Therefore, the null hypothesis was accepted. Most of our findings were impacted teeth; in the case of any suspicion of the presence of impacted teeth during clinical examination, a periapical radiograph would be sufficient to justify the diagnosis

Declaration of Interest

The authors report no conflict of interest.

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