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Brief Communication

Need for a Panoramic Radiographic Assessment Prior to Prosthetic Treatment in Edentulous Patients

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Background and objectives

The purpose of this study was to evaluate the frequency of positive radiographic findings in pre-prosthetic panoramic radiographs of edentulous arches before prior to fabricating complete dentures.

Methods

A total of 60 OPGs (ortho-panoramic radiographs) of edentulous patients who presented either for the construction of new dentures or for the replacement of dentures were selected within a period of one year. All the OPGs were taken using a CBCT machine (PaX-Duo 3D, Korea) with standard radiographic exposures and they were evaluated by a specialist in maxillofacial radiology on the computer screen, without any magnification, for the following radiographic findings: the location of the mandibular canal, the position of the mental foramen, retained roots, impacted teeth, radiolucencies, radiopacities and foreign bodies

Results

The mean age of the population was 65.1 (±9.25) and it consisted of 70% females and 30% males. Among the study population, 8.33% and 6.67% were having retained roots and un-erupted/ impacted teeth respectively. A total of 3.33% cases had the mandibular canal situated at the crest of the residual ridge and the mental foramen was at the level of the alveolar crest in 8.33% of patients. Out of all the cases, only 1.66% and 13.33% of individuals had radiolucencies and radiopacities respectively.

Conclusion

Even though positive radiological findings were observed in the study sample, actual treatment in terms of pre-prosthetic surgery was indicated only in few cases. Therefore, routine panoramic radiographs before fabricating complete dentures are not recommended unless the patient has a clinically obvious sign or symptom.

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Introduction

Achieving good retention, stability and support are the key measures of success in conventional denture fabrication. Therefore, patient assessment and preparation of the mouth are important during complete denture construction. However, routine

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radiographic evaluation of edentulous patients is not commonly practiced due to financial constraints and possible radiation hazards. When the abnormality is masked by apparently healthy-looking mucosa, it is nearly impossible to diagnose by clinical examination only. It is not uncommon to find patients with underlying pathology complaining of pain and discomfort after the fabrication of dentures.

Dental panoramic tomography (DPT) is a radiologic technique for producing a single image of both the maxilla and mandible along with their supporting structures [1]. A panoramic radiograph is often used as a tool in the routine examination, especially in edentulous patients before the construction of a complete denture [2]. Furthermore, it provides convenience to the patient, low radiation dose, high patient acceptability and minimal time expenditure [3]. Limitations of DPTs are the superimposition of structures, magnification and high machinery cost [3]. DPT provides broad anatomical coverage of the maxillofacial region and thus is often used as an initial screening tool for diagnosis and treatment planning [4].

Although the edentulous population is gradually diminishing, there will be a substantial number of edentulous patients still existing [5]. Currently, there are several treatment modalities available to replace their missing teeth and for rehabilitation of edentulous arches. The most feasible and available option are complete dentures, especially in this part of the world.

The frequency of occurrence of clinically undetected pathological findings on radiographic surveys in edentulous jaws has been reported in the past [6]. Some authors discouraged the use of routine dental radiography for patients already wearing complete dentures but needing new dentures, while others have recommended radiography for all such patients [7,8].

Several studies have demonstrated the presence of various pathologies such as impacted teeth, infections, remaining roots, cysts, tumours in the DPTs of edentulous patients [9-13]. The general objective of this study was to evaluate the frequency of positive radiographic findings in pre-prosthetic panoramic radiographs of edentulous arches before making complete dentures. In this study, we assessed the frequency and location of significant radiographic findings in complete edentulous jaws such as the location of the mandibular canal, the position of the mental foramen and maxillary sinus, retained root stumps, impacted teeth, radiolucencies, radiopacities and foreign bodies and evaluate their relevance in prosthetic clinical dentistry.

Materials and Methods

This survey was designed as a cross-sectional descriptive study with convenient sampling. A total of 60 OPGs of edentulous patients who presented to the Department of Prosthetic Dentistry, Faculty of Dental Sciences for the fabrication of a new denture or correction of any problem associated with existing dentures during the year 2016-2017 were selected. Patients with special needs, psychological/ neuromuscular disorders or single arch edentulousness cases were excluded from the study.

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Ethics clearance for the study was taken from the Ethics Review Committee of the Faculty of Dental Sciences, University of Peradeniya, Sri Lanka (No: FDS-FRC/2014/09).

The history was taken, and clinical examination was carried out in all the patients. Then DPTs were performed to identify the bone outline and pathologies. Prior to obtaining radiographs, the aim and objectives of the study were explained verbally to the patient and written consent was taken. Participation in the study was completely on a volunteer basis and did not affect their routine dental management. DPTs were taken using the CBCT machine (PaX-Duo 3D, Korea) with standard radiographic exposures.

All the digital radiographs were evaluated by a specialist in maxillofacial radiology on the computer screen, without any magnification, for the following radiographic findings: retained root fragments, embedded teeth, radiolucencies, radiopacities and location of the mental foramen and mandibular canal. The vertical ramus, mental foramen, maxillary tuberosity, zygomatic process and canine fossa were used as anatomical landmarks to recognize the location of the pathological findings. The positive findings (retained root fragments, embedded teeth, radiolucencies, radiopacities, and foreign bodies) and measured parameters were marked on a pre-designed labeled diagram (Figure 1).

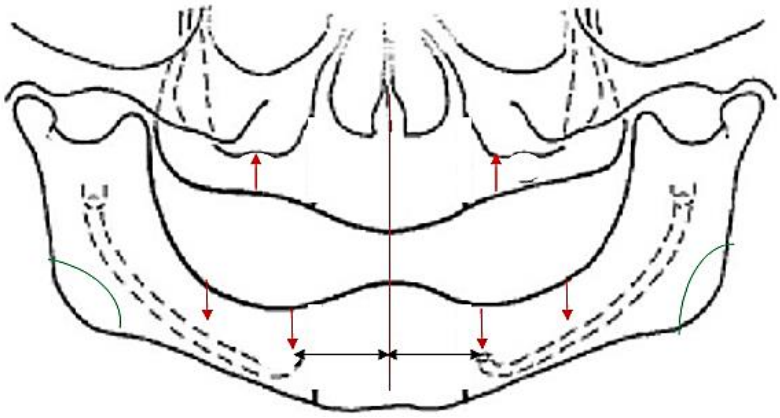

Figure 1: Pre-designed labeled diagram of the maxilla and the mandibular area

All the computations in this study were been performed using the statistical software R 4.0.3. Descriptive statistics, including frequencies, percentages, means and standard deviation (SD), were computed for each variable.

Results

The mean age of the sample was 65.10 years with a range of 45-81 years and the standard deviation was ±9.25. The sample consisted of 70% (n=42) females and 30% (n=18) males. Out of 60 patients included in the study, 36.66% (n=22) were already wearing dentures of

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which 25% (n=15) were women and 11.66% (n=7) were men. The rest (n=38) were waiting for their first new set of complete dentures. Out of that 34.39% were females (Table 1).

Table 1: Distribution of the population according to complete denture wearing.

	newly edentulous patients N (%)	**existing denture wearers N (%)**	**Total (%)**
Males	11(18.33)	7(11.66)	18(30.00)
females	27(45.00)	15(25.00)	42(70.00)
Total	38(63.33)	22(36.66)	60(100.00)

When considering the entire study population, 41.66% (n=25) exhibited positive radiological findings in their denture bearing areas. Among them 8.33% (n=5) had retained root fragments, 6.67% (n=4) had un-erupted/ impacted teeth, 1.67% (n=1) had radiolucencies, 13.33% (n=8) had radiopacities or foreign bodies, 3.33% (n=2) had the mandibular canal at the crest and 8.33% (n=5) had the mental foramen at the crest level (Table 2).

Table 2: Radiographic findings

	N (%)
No radiological findings	35(58.30)
Radiopacities	8(13.30)
Retained roots	5(8.30)
Mental foramen crests	5(8.30)
Impacted teeth	4(6.70)
Mandibular canal at crest	2(3.30)
Radiolucencies	1(1.70)

Retained root fragments

Among the population, 8.33% (n=5) of patients had retained roots. Single root was identified in three cases and two roots were found in two individuals. Out of positive cases 80% (n=4) were male and 20% (n=1) were female. None of the positive cases in this category was wearing dentures. Most of the roots were located in left maxillary quadrant (n=3) and all the others were present in the left mandibular quadrant (Figure 2).

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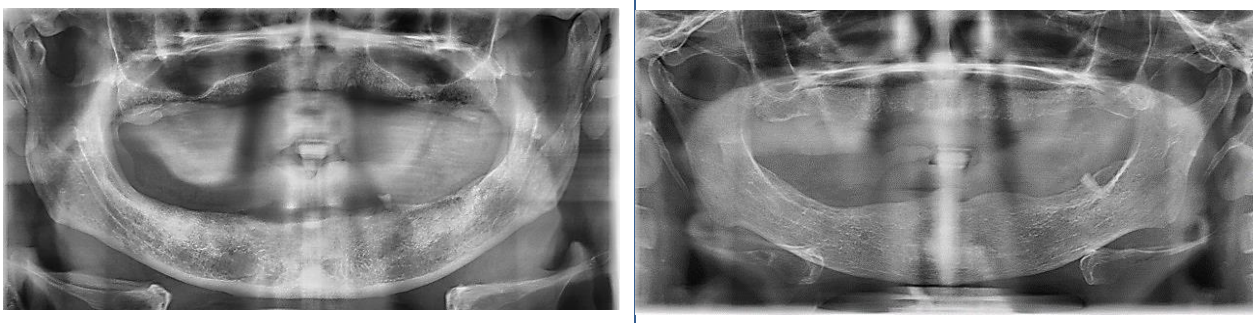

Figure 4: Remaining root fragments in left quadrants

Unerupted/ impacted teeth

A total of six embedded teeth were found in 6.67% (n=4) patients. Out of that, a single embedded tooth was found in two patients and two embedded teeth in 2 patients. Out of four positive cases, 75% were females and 25% were males. Most of the embedded teeth were third molars and the rest of them were maxillary left canines. All the cases were found in existing denture wearers. They were asymptomatic and clinically undetectable.

Radiolucencies

Out of all the cases, only 1.66% (n=1) of cases was positive for radiolucencies. It was present in a newly edentulous female patient in relation to the lower right second molar region. It was diagnosed as a residual cyst in a denture wearer.

Radiopacities

A total of 10 radiopacities were found in 13.33% (n=8) of individuals. Out of 8 positive cases 62.5% (n=5) were female and 37.5% (n=3) were male. Among the positive cases, 50% were already wearing dentures. Two were diagnosed to have salivary calculi (sialolith), while three had calcified soft tissues, two had a foreign body in alveolar mucosa that was most likely to be an amalgam particle, and one had a polyp in the maxillary sinus.

The location of the mandibular canal

In 31% of the radiographs, the location of the mandibular canal (or IDN canal) in both left and right side was not clear. A total of 3.33% (n=2) cases showed that IDN canal was situated at the crest of the residual ridge. Both cases were existing denture wearers.

The position of the mental foramen

In 43.33% of the radiographs, mental foramen could not be detected. A total of 7 quadrants in 5 cases were found as the position of the mental foramen at the level of the alveolar crest in 8.33% (n=5) of patients. Out of 5 positive cases, 60% (n=3) were shown as unilaterally and 40% (n=2) were bilaterally positive. Both bilaterally positive cases were

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belonging to female patients and one was wearing the dentures. Out of 3 unilateral cases, 40% (n=2) of them were male and another one was female. Among those cases, two of them were newly edentulous patients.

Discussion

Numerous studies have been carried out in several countries to assess positive radiographic findings in the jaws of edentulous patients [14]. The assessment of 60 edentulous patients' DPTs in this study revealed positive radiographic findings in 41.66% cases. That is similar to other parts of the world. Comparison of the results of the current study with previous studies is demonstrated in Table 3.

Table 3: Comparison of result of present study with the previous studies.

Author	reporting year	radiographic technique used	sample size	percentage positive cases
Logan	1921	not reported	25	28.60
Eusterman	1921	not reported	290	38.30
Cook	1927	not reported	500	38.00
Gardner &Stafne	1929	not reported	2112	-
Swenson & Hudson [21]	1967	PAN	400	18.00
Perrelet*et al* [22]	1977	PAN	287	41.10
Jones et al [13]	1985	PAN	114	34.40
Angulo F [23]	1989	PAN	200	38.50
Edgerton et al [24]	1991	PAN	308	23.00
Seals RR et al [25]	1992	PAN	448	11.60
Mehdizade et al [26]	2005	PAN	192	-
Masood et al [11]	2007	PAN	327	42.50
Sumer et al [1]	2007	PAN	338	47.60
Ardakani et al [27]	2007	PAN	447	-
Reddy P S [14]	2008-2011	PAN	705	29.07
Present study	2016-2017	Dig PAN	60	41.66

Dig PAN – Digital panoramic radiographs

Participation was completely dependent on the patients' willingness to participate; therefore the sample population was limited. According to the literature that study sample was quite reasonable for this kind of a clinical study [15,16,17]. The most important concern of this study was exposure of ~~the~~ healthy patients to radiation. But due to utilization of rare earth screens and digital radiography, the radiation dose to the patient from the panoramic examination is extremely low and causes with minimal risk [18].

Our study has shown an almost similar percentage of positive radiographic findings among already denture wearers 48% (n=12) and newly edentulous patients 52% (n=13).

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Out of all the positive cases, only one case with retained root was directed for pre-prosthetic extraction.

Almost all the retained roots (8.33%) were found in both upper and lower left quadrants in this study. Unless there is an exact indication for extraction, retained root stumps can be kept under observation. But the patient should be informed and educated regarding its presence and the possibility of infections and future complications. Follow-up examinations with regular periodical radiological investigations are mandatory to identify and minimize future complications.

When the nerve gets compressed between two hard objects it gives rise to pain or discomfort. If mental foramen or interdental nerve is in close proximity with the crest of the residual ridge it may lead to pain or numbness as a result of compression of the nerve by the denture. In this study, mental foramen and interdental nerve existed at the crestal level in 3.33% and 8.33% of radiographs respectively. This phenomenon can happen as a result of alveolar bone resorption and migration of the mental foramen and the inter-alveolar canal towards the upper level of the residual ridge.

In addition, there were a few cases with positive radiolucencies and radiopacities. Unless there was a relevant history, like complicated extraction of a root-filled tooth with remaining Gutta Purcha or a tooth in which apicectomy has been performed with amalgam, it is difficult to differentiate the radiolucent or radiopaque lesions only through the radiographs. If the lesion appears suspicious or changing in location/size, that could be an indication to perform investigations like biopsies or other radiographic modalities [9].

Most of the elderly patients in Sri Lanka are not receiving proper dental care at regular intervals. Therefore, chances of them having a missed pathology are high compared to a person who receives dental treatment regularly. They may also come for the construction of dentures after a long time from the last dental visit. Results of our study have given a message to the dentists who overestimate the clinically healthy-looking edentulous arches and make prostheses over them after a brief clinical examination, by demonstrating a high incidence of positive radiological findings in clinically healthy-looking ridges.

According to the findings of this study radiological investigations can be recommended only to exclude underlying pathologies. The risk of radiation should be weighed against possible benefits, following the ALARA (as low as reasonably achievable) principle.

When considering the clinical relevance of this study, the following clinical factors were identified among edentulous patients. During the clinical examination, the existing denture wearers who complained about poor retention or stability mostly had highly resorbed ridges. The reason may be attributed to the fact that the occlusal forces were transmitted directly to the mucosa through the dentures. An overloaded mucosa may have led to bone resorption and a shift in the position of the mental foramen and

mandibular canal to the crest of the residual ridge. In such a situation, most of the patients complained of pain on biting, or discomfort or numbness in the area due to compression caused by the denture. That was highly significant among long term denture wearers for more than 10 years. Furthermore, the residual ridges were not highly resorbed. In some cases, they have complained about localized pain and discomfort which radiographically revealed retained roots or impacted teeth in denture bearing areas. Considering all the facts a decision should be made to do the investigation according to the relevant clinical presentation. Fabrication of the prosthesis, after excluding all underlying possible pathologies in the denture bearing areas would be really beneficial to improve the quality of life of denture wearers [19,20].

Conclusion

Even though positive radiological findings were observed in the study sample, actual treatment in terms of pre-prosthetic surgery was indicated only in few cases. Therefore, routine panoramic radiographs before fabricating complete dentures are not recommended unless the patient has a clinically obvious sign or symptom.

Limitations

The sample size of the study was small which could be considered as a limitation. It would have been better if the study could have been carried out using a bigger sample in a multi centre set up.

Data availability statement

The collected and processed data used to support the findings of this study are available from the corresponding author upon request and the supporting data used from previous studies have been cited in the text and reference list.

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