Knowledge, Attitude, and Practice, about Digital and Conventional Radiographs among General Dentists and Specialists in Kanchipuram District

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ABSTRACT

BACKGROUND

Radiographs are an important tool in maximizing oral health care. During initial years, the film based radiographic images were used, as technological advancements progressed, digital radiographic imaging has become an indispensable tool in diagnosis. The aim of the present study is to evaluate the practice of digital and conventional radiographs, and radiation safety among dental practitioners.

METHODS

A questionnaire descriptive study was conducted, including general dental practitioners and dental specialists in Kanchipuram district. The questionnaire comprised of 12 questions that were distributed through Google forms, email and responses were collected. The questions were based on their preference about digital or conventional radiographs, reason for their preference, satisfaction with diagnostic quality, patient compliance, and their radiation protection practice.

RESULTS

A total of 200 dental practitioners in Kanchipuram district was given questionnaires. All of them answered the questionnaire. 148 were males and 52 were females. The age distribution was between 26 - 33 years. 65 % of the practitioners answered that they use digital radiographs often owing to less time consumption and ease of storage, 90 % of them answered that their diagnostic quality is improved by using digital radiographs, of which 51 % use radiation protection and 39 % of their patients use radiation protection during exposure.

CONCLUSIONS

This era is moving towards digital radiography, among the ones who are using it, most of them are satisfied with it. Attitude towards radiation protection and hazards has to be improved amongst dental practitioners. The use of digital radiography is increasing among dental practitioners due to its less radiation exposure, improved diagnostic quality, ease of access and as it is less time consuming. The need for availability of standard improved quality of care equally raises the point for cost effective methods for the developing technologies.

KEY WORDS

Digital Radiography, Conventional Radiography, Dental Practitioners, Comparison, Awareness

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BACKGROUND

Radiographs play a vital role in the diagnosis, treatment planning, and follow-up of oral and maxillofacial disorders. Over the course of time, various substantial changes were made in radiographic imaging modalities. Digital radiography was introduced in the mid-1980s by Francis Mouyen. Due to consistent growth in digital imaging in recent years, it is now replacing the conventional radiography in all aspects.

Conventional radiography as a whole consists of cycles of process such as image acquisition, chemical processing, transportation, storage and image display. However, equipment such as cathode-ray tubes for image display, special sensors for image acquisition, and storage devices for image archiving has become more specialized. Thus, key to its success lies in the independent performance of these functions.

New generation technologies and their evolution over the years, facilitated to acquire and display digital radiographic images.[1] It has been proved that digital imaging systems have many effective advantages over conventional imaging system.[2,3,4] One of the major advantages is the contrast and density modulations to improve the overall diagnostic imaging quality.[5] It also helps in dispensing the information among other practitioners and easier to explain to patients by viewing an image on a monitor. A study in 2010 indicates that digital radiograph is a global trend that is considerably thriving due to the rapid evolution of digital technology.[6]

Digital radiography has been available in dentistry for more than 25 years, but digital imaging has not replaced conventional film-based radiography completely. When any new technique such as digital radiography is practiced, usually acquiring the working knowledge about it takes time. The quality of the digital imaging system to control is complicated, as the defining variables are entirely contemporary than conventional imaging systems.

Depending on a type of the sensor for image capturing, the digital radiography can be divided into 2 categories: (1) direct digital systems; and (2) indirect digital systems. Silicon devices like Complementary Metal Oxide Semiconductor (CMOS) or Charge Coupled Devices (CCD) are a direct digital system. CMOS or CCD sensors are also known as solid-state detectors. Storage Phosphor Plates (SPP), also referred as Photo Stimulable Phosphor Plates (PSP) are example of indirect digital system.[7]

Digital panoramic radiography usually exposes a low dose radiation than conventional radiography.[8] The effects of the X-ray on the living tissue are quite harmful and lethal which could lead to serious complications,[9] therefore, it is very pertinent to understand the potential risks and preventive measures accurately.

Although digital radiography is getting increasingly popular, there are various imaging parameters that play a role in diagnostic quality. The aim of the present study is to evaluate the practice and awareness of digital and conventional radiographs among general dentists and specialists in Kanchipuram district.

METHODS

A questionnaire descriptive study consisting of 12 questions was conducted among 200 dental practitioners of which all of them answered; among them 148 were male and 52 were female. The questionnaire is distributed among the practitioners via email. The questionnaire was self-prepared containing 12 questions. For content validation of these questions, a pilot survey was done with ten dental practitioners. All the contents of questionnaire along with multiple options are checked by the experts and reliability was 100 %. Validated questionnaire result is 80 % for this study.

The questionnaire was divided into a number of sections. The first information on participants' socio-demographic and practice characteristics. They had been asked whether they used digital radiography. The questionnaire consists of reasons for preferring digital radiographs, reasons for preferring conventional radiographs, quality, patient and operator compliance and about both operator and patient radiation protection practice. Informed consent before the survey was obtained from the practitioner. This investigation was approved by the Institutional Review Board and met all requirements regarding research involving human subjects, including informed consent and ethical conduct.

Inclusion Criteria

Dental practitioners in Kanchipuram district were included who were willing to participate.

Exclusion Criteria

The practitioners who were not willing to participate or not available during the survey were excluded from the study.

Sample Size Calculation

Sample size is calculated using G-power software, a prior analysis with standard error as 5 % and power of the study as 95 %, the minimum sample size was calculated as 200.

RESULTS

Questionnaire was distributed among 120 dental practitioners; all 120 practitioners answered the questionnaire; 48 were male and 72 were female; the age distribution was 27 - 33 years; majority of the respondents was general dental practitioners (21 %), oral surgeons (14.9 %), endodontists (13 %).

65 % of them answered that they use digital radiographs often and 48 % use conventional radiograph often, 90 % of them answered that their diagnostic quality is improved by using digital radiographs. 38 % of them choose digital radiograph for panoramic diagnostic image, and 29 % for periapical and 12 % for cephalometric, 13 % for CBCT and 8 % of them use 3D-CT.

24 % of practitioners use digital radiograph to detect relationship of mandibular third molar to IAN (Inferior Alveolar Nerve) and 35 % of them use digital radiograph to

evaluate extent of large lesions, 12 % for post-operative care and 15 % for trauma.

62 % of practitioners do not use digital radiographs as they are expensive, 6 % because of poor image quality, 17 % because of no nearby centres for digital radiography, difficulty in operating 5 %. 32 % use digital radiography as they can assess the images immediately, 26 % for ease of image storage, for image adjustments 16 %, 12 % for less time consumption, as less radiation dose only 3 % and for all of the above reasons 11 % responses. 72 % of practitioners were satisfied with the digital radiography, 76 % patients of practitioners were satisfied with the digital radiography. 51 % of the practitioners used radiation protection and 39 % of their patients used radiation protection during exposure.

Question	Answer	Response
Designation	Endodontist	26 (13 %)
	Periodontists	20 (10 %)
	General Dentist	42 (21 %)
	Oral Medicine	24 (12 %)
	Oral Surgeon	29 (14.49 %)
	Paedodontist	12 (6 %)
	Orthodontist	21 (10.5 %)
	Prosthodontist	26 (13 %)
Type of radiographs for digital imaging	A. Panoramic	76 (38 %)
	B. Periapical	58 (29 %)
	C. Cephalometric	24 (12 %)
	D. CBCT	26 (13 %)
	E. 3D - CT	16 (8 %)
Why do you prefer digital radiographs	A. Relationship of mandibular third molar and inferior alveolar nerve canal	48 (24 %)
	B. Evaluate the extent of large lesions	70 (35 %)
	C. To evaluate trauma	30 (15 %)
	D. Post-operative examinations	24 (12 %)
	E. All of the above	28 (14 %)

Table 1. Various Specialists, Type of, and Usage of Digital Radiography

Question	Answer	Response
Reason for not Using Digital Radiographs	A. Expensive	124 (62 %)
	B. Poor image quality	12 (6 %)
	C. I do not have necessary equipment	16 (8 %)
	D. Difficult to perform	10 (5 %)
	E. No nearby Centres	34 (17 %)
	F. All of the above	4 (2 %)
Reason for Using Digital Radiographs	A. Radiation dose is reduced	6 (3 %)
	B. Less time consumption	24 (12 %)
	C. Immediate assessment of images	64 (32 %)
	D. Ease of image storage	52 (26 %)
	E. Images can be adjusted	32 (16 %)
	F. All of the above	22 (11 %)

Table 2. Reasons for Preference of Digital Radiography

Question	Answer	Response
Frequent Use of Digital Radiographs	A. Often	130 (65 %)
	B. Very Often	46 (23 %)
	C. Rare	24 (12 %)
Frequent Use of Conventional Radiographs	A. Often	96 (48 %)
	B. Very Often	56 (28 %)
	C. Rare	48 (24 %)
Satisfaction with Digital Radiography	A. Satisfied	144 (72 %)
	B. Neutral	48 (24 %)
	C. Unsatisfied	8 (4 %)
Preference for Diagnostic Quality	A. Digital Radiography	180 (90 %)
	B. Conventional Radiography	20 (10 %)
Patient Preference	A. Digital Radiography	152 (76 %)
	B. Conventional Radiograph	48 (24 %)
Radiation Protection is Used by the Operator?	A. Yes	102 (51 %)
	B. No	98 (49 %)
Patient uses radiation protection?	A. Yes	78 (39 %)
	B. No	122 (61 %)

Table 3. Responses for Frequency, Satisfaction, and Radiation Protection of the Practitioners

DISCUSSION

Radiographs are widely used in dentistry to enhance the management of the patient. It is an essential diagnostic tool in dentistry and key determinants of appropriate diagnosis. In dental practice, digital radiography is slowly becoming an irreplaceable part. A preference for digital vs. conventional radiographs is increasing among dentists with technological advances.[10,11]

The principal aim of the present study was to evaluate the extent of interest in digital radiography and conventional radiographs among dental practitioners. In our study, 65 % of them answered that they use digital radiographs often and 48 % use conventional radiographs often, 80 % of them answered that their diagnostic quality is improved by using digital radiographs. Dolekoglu et al.[12] reported that 67 % of Turkish dentists used digital radiography. According to Lee et al.[13] digital sensors were used by 77.2 % of the Korean dentists. Still, digital radiography is yet to reach extensively in Indian dental practitioners compared to developed countries.

Several other studies evaluating dentists' attitudes towards digital radiography reported different reasons for the popularity such as time efficiency, absence of a need to develop images, ease of image storage, and reduced radiation[14], as compared to our study results. We found that digital radiography may be of crucial value for dental practitioners as it allows rapid decision making for optimal diagnosis and treatment plans.

90 % of the practitioners believe that digital radiography increases their diagnostic ability. Similar to our result, most of the studies have accomplished that the diagnostic value of digital images is improved than that of conventional radiographs.[15]

Non-availability and cost of equipment were the major reasons cited for non-use of digital techniques, in accord with previous studies such as Brian et al,[10,16] as similar to our study 62 % of practitioners do not use digital radiographs as they are expensive, 6 % because of poor image quality, 17 % because of no nearby centres for digital radiography, difficulty in operating systems 5 %.

The major disadvantages of digital radiography include reduced spatial resolution, and limited sensor size and flexibility, however 72 % of our sample indicated satisfaction with the currently available techniques, which is more than the proportion reported by Reddy et al.[14]

In our study, 51 % of the practitioners used radiation protection, whereas Chaudhry et al[17] observed that 31 % of dentists in the national capital region use the lead apron while taking the radiography. Yet most of these studies showed the neglect of radiation safety by dental practitioners. In the present study although more than 50 % uses radiation safety only 39 % of their patients used radiation protection during exposure. Hintze et al[18] showed that there was reduction in exposure for digital imaging up to 25 %, which was statistically significant with phosphor plate systems.

Digital radiography practices are more common in developing centres with heavy population and the contemporary technologies are essential. Thus, this necessitates the need of advanced training for practitioners and also enhanced digital services in these developing centers. It can be inferred from the study that there is lack of

knowledge in regard to radiation protection protocols and radiation hazards itself and also the major reason for not using digital radiography is because of its cost factor. The need for availability of standard improved quality of care equally raises the point for cost effective methods for the developing technologies.

This study had some limitations where the number of respondents could not be controlled. Moreover, the number of respondents varied among specialties, working sectors and not equally distributed.

CONCLUSIONS

Although the film system had better resolution than the digital imaging systems, it was not proven to be clinically important. With developing modern technologies, there continues improvisation of image quality in digital systems at lower radiation doses. Digital radiographs are expensive, difficult to access, require less equipment for film storage, and require less manpower. Templating of images is easy in digital radiography, as the images are comparable to anatomical size. Though many still use conventional radiographs, the future is digital radiographs. Better detectors, faster image processing, bigger and sharper displays will transform the diagnostic imaging modality. Virtual displays may play a role in future diagnostic imaging. Though the world is rapidly digitalizing in various fields, the need for digital radiographic growth is mandatory in all parts of the country irrespective of the population and settlements in India. The need for diagnostic and treatment standardizing is a growing necessity for balanced health care.

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