

Is the transition to digital era here? A cross sectional study amongst Dental Practitioners vis-à-vis the usage of digital imaging in Bhopal

Abstract:

Background: Scientific evidence supports the idea that transitioning from conventional to digital radiography is now essential since it reduces exposure to ionizing radiation. The primary aim of this study was to assess the attitude, awareness and knowledge of dental practitioners of Bhopal, to the use of digital radiography. The objectives were identifying reasons for incorporating digital imaging, and the attitude towards wanting to make a transition from conventional method.

Methods: A cross-sectional survey was conducted amongst the private dental practitioners in Bhopal, Madhya Pradesh. A structured questionnaire was shared using Google platform.

Results: Out of the 350 respondents, 279 (79.71%) reported using digital radiography, with 32.85% believing that the benefits of digital radiography were the decreased patient exposure, improved image, long-term cost savings, and improved image quality in particular to see the root canals and measure bone loss.

Conclusion: There is a paradigm shift in preference of digital imaging.

Key-words: Digital imaging, dental practitioner, dosage, radiography.

Introduction:

Imaging plays a pivotal role in assessing prognosis, formulating treatment plan, and establishing the outcome of various therapies. Digital imaging has gained popularity amongst the general dental surgeons as it is time saving, easy to use, negates the use of dark room, facilitates tele-radiography and image archiving. Decreased patient exposure in digital imaging is an important feature, as directed by the ICRP and studies done by authors like Ludlow JB et al [1-3]. Added advantages include absence of chemical processing which in turn leads to a reduction in hazardous waste, image enhance-ability and reproducibility. Display of the patient's image on the monitor has led to better patient compliance. Although digital imaging offers some unique advantages over conventional films, but like any emerging technology, it presents new challenges for the practitioners to overcome. There have always been contradictory opinions regarding the accuracy of digital versus conventional radiographs [4,5].

In any dental set up, radiographs play a crucial role in diagnosis and treatment planning. Precise diagnosis with lowest possible radiation dose should be the aim of a dental radiologist [6]. Before the advent of Radiovisiography, the widely used imaging modality was conventional film-based radiography [7].

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Digital radiography is broadly divided into direct and indirect digital systems, depending on the type of sensor used. Direct digital system uses silicon components in the form of solid-state detectors like complementary metal oxide semiconductor (CMOS) and charge coupled devices (CCD). Indirect digital systems include storage phosphor plates or photostimulable phosphor plates (PSP).[8,9,10,11]

Good image resolution, cost effectiveness and ease in placement at different intraoral sites could be the reasons for the choice of conventional radiographic films over digital sensors. Many studies have shown that RVG was superior to IOPA for the detection of interdental bone loss. Less radiation exposure and time saving ability of digital radiographs are the reason that these have gained popularity in the present era.[11]

Progress occurs when we are open to change and newer technologies. Being receptive to these advancements enable us to adapt, evolve and make significant difference in our professional aspect. The present study is aimed at gaining insight into the attitude of dental practitioners of Bhopal, to digital radiography.

MATERIALS AND METHODS:

Study design:

A cross-sectional survey was designed to assess knowledge, awareness and attitude to digital imaging among the Private Dental Practitioners in Bhopal, Madhya Pradesh. A structured questionnaire was shared using Google platform.

Sample size:

The developer's website's Raosoft® program was used to determine the sample size[12]. At the time this study was being conducted, the population of the city of Bhopal was estimated to be 2.3 million.[13] The required sample size was calculated to be approximately 380, assuming a 95 percent confidence level with an expected 50% response distribution and a margin of error of ±4%. The most prominent private dental practitioners were searched using the Google search engine and the questionnaire was sent on the provided email ID.

Inclusion / Exclusion criterion:

Private dental practitioners who were currently employed or were running their own private dental clinics were selected. Dental practitioners who did not consent to answering the questionnaire, were excluded from our investigation.

Questionnaire validity:

The questionnaire containing 10 questions was self-prepared. For validation a pilot study was conducted on 50 Private Dental Practitioners. Cronbach's co-efficient was found to be 0.88 proving the questionnaire's reliability. The validity of the questionnaire was tested on the following grounds: It was tested by expert validation assessed by Cohen's Kappa. An expert panel of five members was tested. A value of 0.88 was found, suggesting acceptable inter-rater agreement for the items of the questionnaire by the experts. After checking for the reliability of the questionnaire, the same panel evaluated its adequacy and sufficiency in measuring the questionnaire. Every item was deemed necessary by all of the experts. Content validity ratio (CVR) was evaluated using Lawsche's method, calculated using the formula,

$$CVR = \frac{ne}{N/2}$$

N/2,

where "ne" is the number of expert panel members indicating "essential," and N is the total number of expert panel members. All 10 items were scored on a range of 1 to 3 as "not necessary," "useful but not essential," and "essential." The final score of the CVR was 0.86. All the items were scored as "essential," and hence all questions or items were included in the final questionnaire.

Content Validity Index (CVI) was scored for each item. The item-content validity index (I-CVI) for all 10 items was scored in the range of 0.95 - 1, thus suggesting 100 percent agreement. The scale level-content validity index (S-CVI) was based on the summary of all the I-CVI, which was scored at 0.88, thereby making it a relevant questionnaire.

Statistical analysis:

The data obtained were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) Version 23 (Chicago Inc., IL and USA). Data comparison was done by applying Chi Square test.

Results:

Out of 350 respondents 146 were MDS and 204 were BDS practitioners. 51.8 % of the respondents had their dental practice for less than 5 years, 32.7% between 6-10 years where as 15.5% practitioners were practicing for more than 11 years. 279 (79.71%) used digital radiography, remaining 71 practitioners who used conventional imaging; 93.5 % of these contemplated to shifting to digital imaging.

The response of BDS and MDS practitioners to knowledge and attitude of digital radiography is precisely denoted in figure 1.

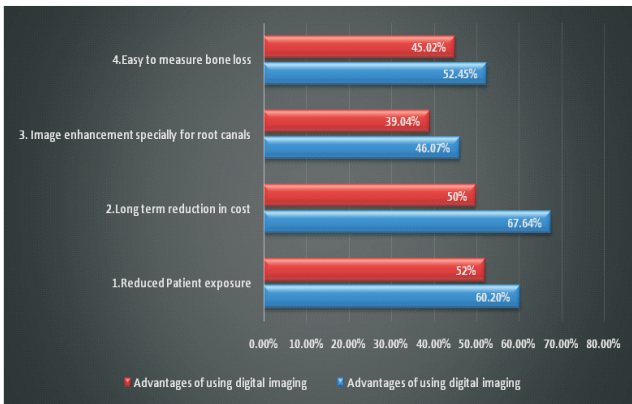


Figure 1- Advantages of using digital imaging as per MDS/BDS Practitioners

45% respondents agreed that image enhancement was an added advantage in digital radiography (figure 2).

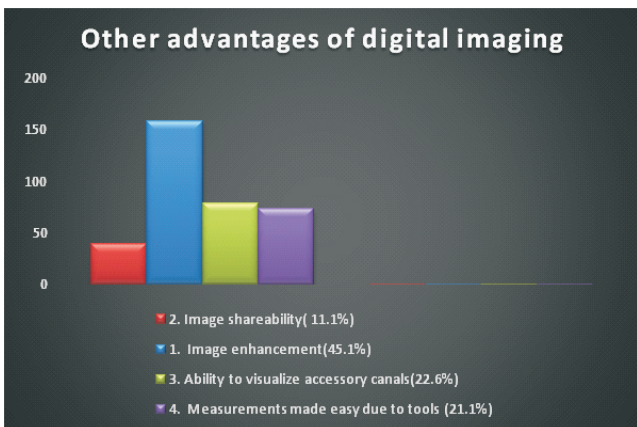


Figure 2: shows other advantages of digital imaging according to respondents

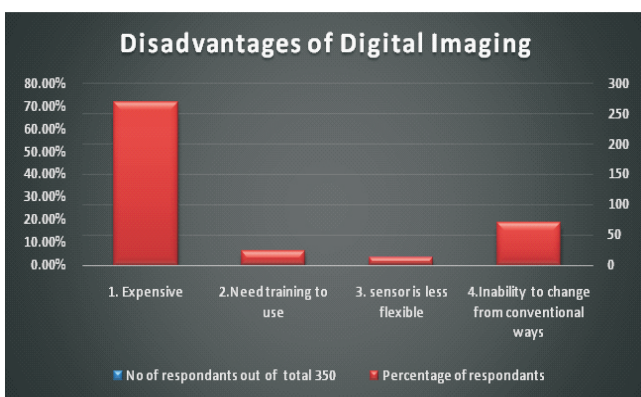


Figure 3-Disadvantages of digital imaging

70% respondents quoted high cost as the reason for not using digital radiography (p=0.0) (Figure 3).

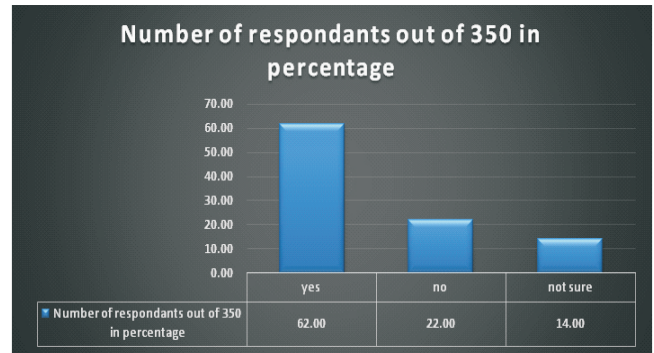


Figure 4: shows the opinion of respondents regarding use of digital imaging and tele-dentistry during Covid-19 pandemic 62% of respondents said that tele-dentistry was apt during a pandemic (figure 4).

Discussion;

Electronic imaging was first introduced by Dr. Francis Mouyen in 1984. Digital images are composed of a grid of picture elements (pixel) where each pixel represents a specific area of the image. The spatial distribution of these pixels is discrete. [12, 13]

Long term reduction in cost and reduced patient exposure were the salient points which stood out in the responses in present study (Figure 1), which was concurrent with the findings of Dolekoglu S et al. [14]

45% agreed image enhancement and manipulation was a major advantage of digital imaging. 22% respondents felt that ability to visualize accessory canals during root canal treatment was better in digital imaging as compared to the conventional technique. 11% practitioners found that image sharing, image storage and accessibility was an important advantage of digital radiographs (Figure 2).

For a change in mineralization to be visible on a radiograph using traditional radiography, it needs to be between 30 and 60% [15-17]. Due to cancellous bone's lower mineral content than cortical bone, lesions confined to it could not be detected either [18-19]. However, digital radiography allows for the detection of alveolar bone changes of 1-5% per unit volume and significant variations in crestal bone height of 0.78 mm [20,21]. Additionally, flaws of at least 0.49mm in cortical bone depth can be seen, whereas a lesion needs to be at least three times larger to be found using traditional radiography techniques [19, 22].

Radiology plays an integral role in establishing bone loss at

crest of alveolar ridge and interdental defects resulting from periodontitis. Accurate measurements between alveolar crest and root surface is critical in treatment planning for dental implant placements, periodontal surgeries and other interventions. Bone loss measurement was easier using digital method as stated by 53% of our participants (Figure2), an observation shared by Mathur H et al.[23, 24]

The initial expense in setting up digital imaging system and the hesitation to undergo training may be considered as hurdles to overcome to adopt this imaging technique. Long term cost effectiveness and convenience has eliminated the need for film and film developing has proven RVG superior to the conventional films. The economic effectiveness of digital imaging for small dental practitioners was doubtful in the present study. In our study, 70% respondents stated high cost as the reason for not adopting digital imaging which is concurrent with Brian et al [25] and Masyte et al [15]. One of the disadvantages of Digital imaging can be some legal issues, as digital images can be manipulated by using software, their evidence in lawsuit is debatable.[13]

Tele-radiology involves the use of telecommunications systems to transfer radiological images between locations. The present study reported 62 % of the respondents using tele-dentistry during Covid- 19 pandemic (Figure 4) which is in agreement with Bargale S et al [26] and Ramakrishnan DS et al.[15] This was in contrast to a study by Pal et al .[27]

Watson stated that familiarity and ease of use made conventional radiography preferable over digital radiography [28]. Svenson BAH et al [29] reported that only 2% of dentists of the Swedish dental society still used conventional radiography, which was similar to our study.

Digital radiography can identify root resorption as little as 0.5mm, quantitative evaluation of bone loss, minute demineralization changes thus facilitating subtraction imaging [30] Therefore, this technique can be used to study any lesion that has the potential to alter over time, including bone cysts or tumors [31]. Recurrences in bony lesions, post-surgical follow ups and easy patient acceptability make this technique stand out as compared to conventional method[31].

Tele-dentistry involves forwarding remotely monitored clinical information, radiographs, photos, and lab tests to specialists for consultation and treatment planning. In the

present study 62% dental practitioners agreed that use of digital imaging was highly beneficial in tele-dentistry during covid pandemic, whereas 22% were not in agreement and 14% were not sure. Similar views were noted by a recent study on use of tele-dentistry during covid19 pandemic done by C Rocco et al in year 2023 [32].

Variables such as gender-related motivations pertaining to usage of digital radiography and socioeconomic data of the respondents could be one major flaw in the present study. However, this was one of the few studies in Central India that attempted to establish some kind of correlation between awareness about digital radiographic techniques amongst private dental practitioners. Further studies should be conducted to validate the results that have been obtained.

Conclusion:

Conventional imaging has low diagnostic sensitivity and high specificity as compared to digital imaging whose sensitivity and specificity are high. Change brings progress and digitization over conventional methods is a sure step to transformation. Embracing newer technologies and innovations enables us to streamline workflow and maximize our output, finally enhancing our productivity. There is a definite shift amongst the Dental practitioners in Bhopal towards digital imaging.

Limited sample size and consideration of dental practitioners only from the urban areas could be a drawback of the present study. Even with present limitations such studies provide a foundation for further investigation and understanding.

Conflict of Interest:

No conflict of interest was reported by the authors in conducting this questionnaire-based investigation.

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