

Imaging Prescription Patterns Among Dentists

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Abstract: To our knowledge, there are no data in the English literature to characterize the pattern of prescribing images among dentists. Therefore, we surveyed dentists to determine their habits when requesting images for their patients. Ninety-five recent graduates were surveyed before a continuing education lecture, of which 93 responded. We found that recent graduates are unclear about the indications and limitations of the different dental imaging modalities. Therefore, continuing education courses in oral radiology that discuss and compare the available imaging techniques are needed to achieve optimal patient care.

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I. Introduction

Dental imaging plays a pivotal role in the diagnostic armamentarium of dentists and dental specialists. This also plays a significant role in the treatment planning and follow-up processes. Great variations exist among dentists in their prescription (requisition) habits. More importantly, dentists and dental specialists tend to overprescribe images for their patients, taking advantage of the availability, ease of use, and relatively low radiation dose associated with these imaging techniques.(1) This is of concern for three reasons; first, the risk of stochastic effects (e.g., cancer) is present even for relatively small radiation doses.(2) Second, the accumulative risk of repeated radiation exposure is well-known and documented.(3) Lastly, even if the risk for an individual is small, when multiplied by the large number of patients receiving these images, the risk becomes a significant public health problem.(2-4)

One of the easiest and most efficient ways to minimize the risks of radiation exposure is patient selection.(5) Patient selection for any given radiographic imaging procedure should depend on selection criteria. Selection criteria include: age of the patient, medical and dental history, and clinical signs and symptoms. It has been estimated that up to one-third of Computed Tomography scans acquired for patients are not justified.(6) The stricter the selection criteria, the more justified every imaging request will be, and the less unnecessary exposures will happen, thereby sparing patients the harmful effects of ionizing radiation. Unjustified additional imaging can also be avoided by radiologic consultation.(7) A large number of advanced imaging requests are based on lack of knowledge of normal variations from the requesting dentist.(8)

Technological advances have not only introduced new imaging techniques, such as cone beam computed tomography (CBCT), but have also made existing imaging modalities more efficient so that fewer radiation doses are delivered to the patient. Unfortunately, we have not been able to eliminate the harmful effects of radiation exposure, and the fear of cancer looms large over dentists and their patients. Therefore, every effort must be made to minimize the risks associated with diagnostic radiation exposure in keeping with the internationally accepted ALARA (As Low As Reasonably Achievable) and, more recently, ALADA (As Low As Diagnostically Acceptable) concepts.(4)

II. Materials and methods

A 15-question survey (**Appendix A**) was developed to determine the habits of dentists when requesting images for their patients. Then, after ethical approval, the survey was distributed among 95 recent graduates before a continuing education lecture; of which 93 responded. Participation was optional, and the respondents were free to withdraw at any point. Simple descriptive statistical analysis was performed.

III. Results

More than 90% of the dentists surveyed were unaware that there is no radiation dose limit for patients (**Figure 1**). Fortunately, most respondents (73%) confirmed that every new dental patient does not require a panoramic radiograph unless the patient is in the mixed dentition phase, in which case 91% of the dentists confirmed the need for a panoramic radiograph. With regards to the need for bitewing radiographs for new dental patients, 81% agreed that they are indeed needed. These data are summarized in Figure 1. Also, the majority of respondents (87 dentists, 93%) agreed that patients with high caries risk required bitewing radiographs to be made more frequently.

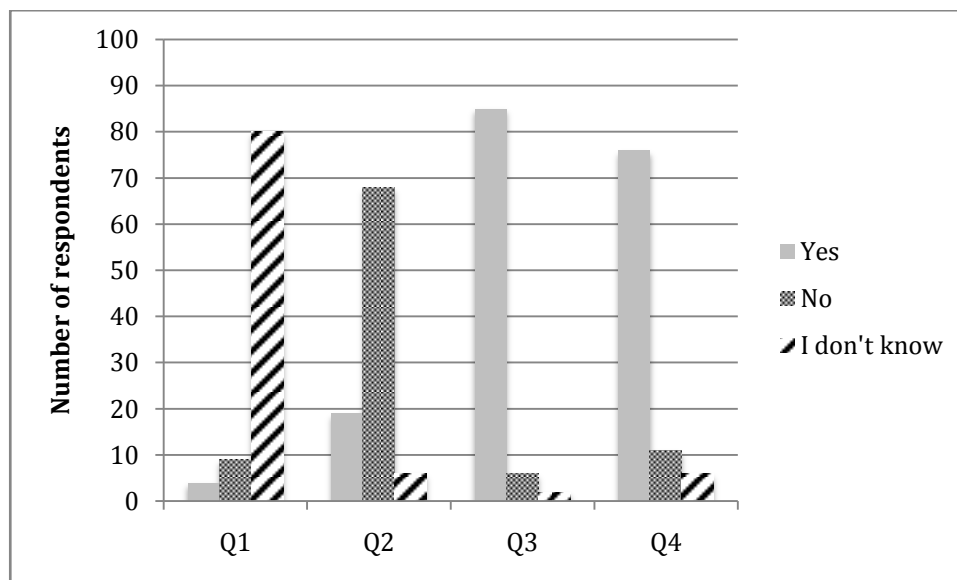


Figure 1: Number of respondents according to their responses to the first four questions of the radiographic prescription survey.

Next, we examined the choice of imaging technique or modality for the various possible indications. For detection of proximal caries, 93.5% choose bitewing radiographs correctly. However, only 33% chose the correct type of radiographs (bitewings) for examination of the periodontal crestal bone level; whereas the majority (61%) opted for periapical radiographs. An overwhelming majority (94%) chose the incorrect answer of bitewing radiographs for assessment of tooth restorability. A reassuring majority (84%) chose panoramic radiographs for initial assessment of impacted third molars. Unfortunately, initial assessment of a potential implant site warranted advanced imaging in the form of CBCT for most dentists surveyed (76%), and only 12% chose panoramic radiographs. These data are presented in Figures 2 and 3 respectively.

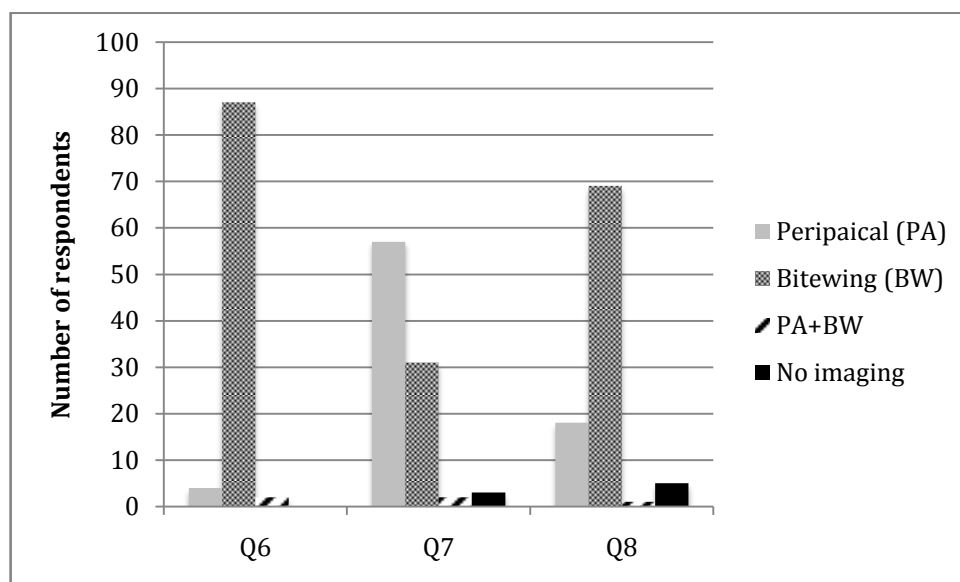


Figure 2: Number of respondents according to their responses to questions 6-8 of the radiographic prescription survey.

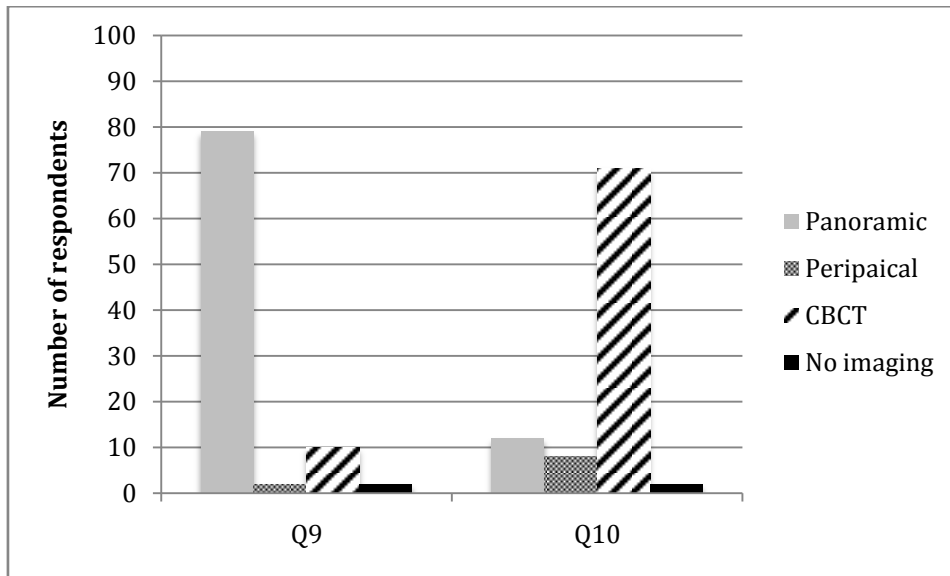


Figure 3: Number of respondents according to their responses to questions 9 and 10 of the radiographic prescription survey.

When asked about which imaging modality is recommended for patients with suspected midface trauma, 79% correctly recommended a CT examination; whereas only 51% chose CT for assessment of a submandibular space abscess. When asked about imaging patients with symptoms related to the temporomandibular joints (TMJ), the answers of the respondents varied. For example, when asked about a patient with TMJ clicking, 43% chose (No imaging), 32% chose (Panoramic radiograph), and 20% chose (CBCT). When given a scenario about a patient complaining of progressively deviated mouth opening, 46.2% chose CBCT and 40.8% chose Magnetic Resonance Imaging (MRI) (Fig. 4 and 5). Finally, we asked about imaging pregnant patients and the overwhelming majority (88%) chose to image but with special precautions, as opposed to imaging using the same approach applied to regular patients (7%) or not imaging at all (1%).

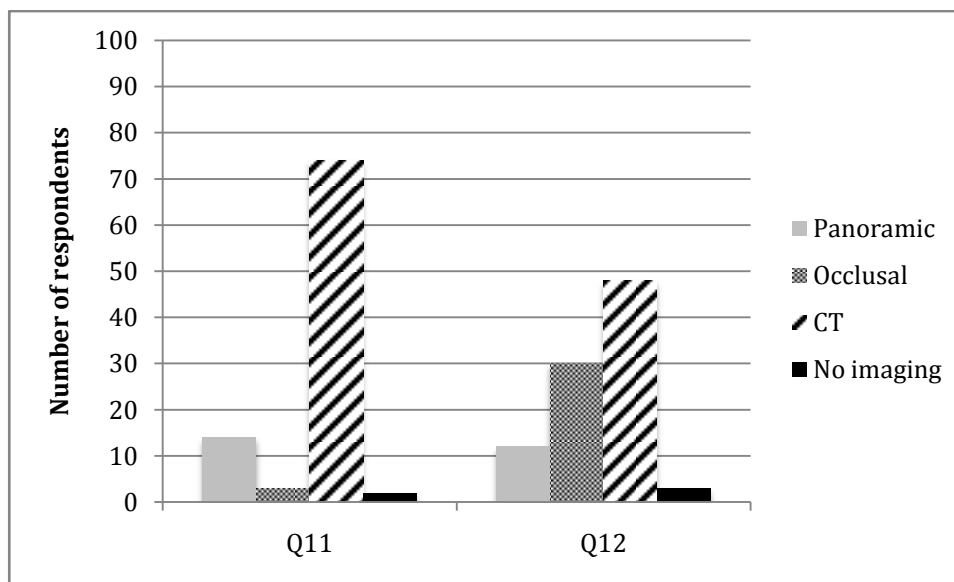


Figure 4: Number of respondents according to their responses to questions 11 and 12 of the radiographic prescription survey.

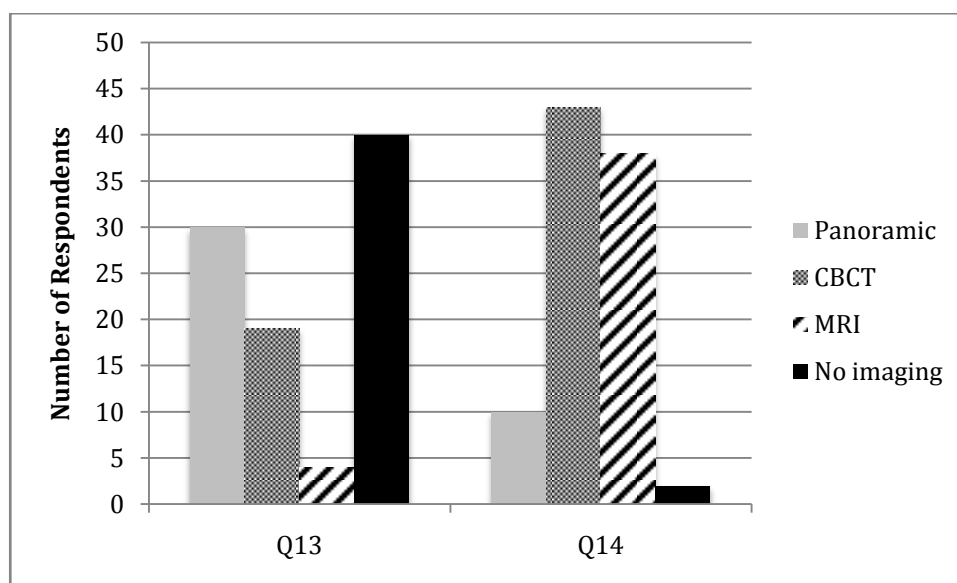


Figure 5: Number of respondents according to their responses to questions 13 and 14 of the radiographic prescription survey.

IV. Discussion

Numerous respondents revealed confusion and lack of knowledge regarding vital areas in dental radiographic prescription. More than 90% of our sample did not know that there is no radiation dose limit for patients as long as the imaging is justified and the diagnostic benefit of imaging exceeds the risk of radiation exposure. However, there is a dose limit for healthcare workers, such as dentists, which is set at 20 mSv per year, averaged over 5 years, with no single year exceeding 50 mSv.(9) A similar survey was conducted in Norway in 2017 on final year medical students to assess their awareness and knowledge of radiation dose, and the results (like ours) demonstrated a low level of knowledge (as defined by the authors).(10) Other similar studies have confirmed this finding, but our results are the first to demonstrate this problem among dentists.(11-13)

Prescribing panoramic radiographs was of interest to us because we had noted that many dental institutions had systems in place where every new patient received a panoramic radiograph. We have a two-fold approach to this problem: 1) change the system in place; and 2) educate all parties about the most recent recommendations, including students. It seems our efforts have been fruitful and most recent graduates do not justify the need for screening panoramic radiograph, except if the patient is in the mixed dentition phase. Screening panoramic radiographs are not justified as the majority of the findings revealed by these, if any, are not significant.(14-16) The practice of screening panoramic radiographs is no longer acceptable as it does not meet the current standard of care recommended by the American Dental Association (ADA) nor the American Academy of Pediatric Dentistry (AAPD) for patient selection and limiting radiation exposure.(17, 18)

The same caution when prescribing panoramic radiographs did not carry to bitewing radiographs. Almost two-thirds of our respondents chose to prescribe bitewing radiographs for every new dental patient. Perhaps because bitewing radiographs are small, and their perceived radiation dose is thought to be small, which might not be the case depending on the technical parameters used during exposure.(19-21) Also, the prescription of any form of imaging should not be taken out of context and should always follow a thorough history taking and clinical examination, so as to ensure that the best clinical decision is being made. One of the important factors to consider when prescribing bitewing radiographs is the caries risk. The higher the caries risk, the more frequently bitewing radiographs should be made to detect early carious lesions and attempt to manage them conservatively. The results of the current study demonstrated an understanding of this concept; however, future surveys of this kind should also enquire about bitewing frequency for patients with low caries risk to ensure a solid understanding of this concept.

The crestal bone level is critical when evaluating the periodontal condition of patients. To capture the most accurate representation of the crestal bone level, bitewing radiographs are required.(22) Periapical radiographs can be misleading because of errors related to their vertical angulation. Unfortunately, most of our sample incorrectly thought that periapical radiographs were required to evaluate the periodontal bone level. Similarly, most respondents incorrectly thought that bitewing radiographs were best for assessment of tooth restorability, whereas in fact a combination of bitewing and periapical radiographs is needed for that kind of assessment.(22,23)

Most impacted third molars can be evaluated without the need for advanced imaging and have been for many years. Numerous studies have been conducted in recent years to compare panoramic radiographs, which are considered the gold standard for examining impacted third molars, against three dimensional examinations. These studies have consistently found no significant differences between the two imaging modalities and most clinicians advocate that advanced imaging be reserved for complicated cases of molars abutting the mandibular canal, for example. Fortunately, most of the respondents in this study also chose panoramic radiographs for initial assessment of impacted third molars. Conversely, most respondents chose advanced imaging (CBCT) for initial assessment of potential dental implant sites and, indeed, 3D imaging has become the standard of practice prior to surgical dental implant placement. Nevertheless, panoramic radiographs remain the recommended imaging modality for initial assessment of a potential implant site.(24)

Trauma patients, especially midface trauma patients, should undergo 3D imaging to assess any possible indolent injuries and fractures.(21) Fortunately, most of our respondents were aware of this standard of practice for trauma patients. The same did not apply to patients suffering from submandibular abscesses, as only 50% choose Computed Tomography(CT) as the recommended imaging modality and nearly one-third of the dentists chose occlusal radiographs. This result is worrisome for two reasons. First, it demonstrates a lack of understanding of the limitations of conventional radiographs, such as occlusal images, to demonstrate soft tissues. Second, it indicates a lack of understanding of the seriousness of submandibular abscesses that can progress rapidly and perilously affect the airway. Therefore, educational programs for undergraduate dental students, postgraduate dental students, and continuing education courses for dentists should emphasize the advantages, limitations, and indications of the various imaging modalities and techniques. These courses should also stress the importance of advanced imaging for life-threatening conditions.

Dental patients often present to their dentists with signs and symptoms related to the TMJ. Therefore, dentists should be aware of the best imaging modalities for this complex structure. It is unanimously agreed upon that CT or CBCT imaging is best for assessment of the osseous structures of the TMJ; whereas MRI is the best imaging modality for assessment of the soft tissue structures of the TMJ. Progressive deviation of the mouth is usually an indication that there is an underlying osseous problem that needs to be diagnosed and managed and, therefore, CT or CBCT imaging is justified. TMJ clicking usually indicates discal displacement that can be viewed with MRI. However, TMJ clicking is a common finding; so much so that some consider it a normal variation and most do not justify imaging of the TMJ for this symptom, unless combined with other symptoms, such as pain.

The concepts that were understood by the dentists in our sample were: First, that bitewing radiographs are the imaging modality of choice to detect proximal caries; Second, that to determine tooth restorability we need both bitewing and periapical radiographs; Third, almost all dentists in our sample understood the need for high-risk patients to receive bitewing radiographs every 6–12 months and that it is justifiable to prescribe radiographs for pregnant women, when needed.

We are unaware of any other study that has examined the prescription pattern of dentists and examined their knowledge of imaging techniques. Future directions include applying this survey to dentists that have been practicing for a number of years and dental specialists.

V. Conclusion:

There are inconsistencies in the knowledge of recent dental graduates regarding the indications and limitations of the imaging techniques available to dentists. These findings should be used to redesign dental curricula in dental schools and design continuing education programs.

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