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NOTE

A survey of patient contact shielding in dental teaching hospitals in the UK

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Abstract

A high volume of dental imaging is carried out each year. In the UK, guidance on the use of patient contact shielding for these investigations is published by the British Institute of Radiology (BIR) and in a document jointly produced by the Faculty of General Dental Practice and Public Health England (FGDP/PHE). Both these sources of guidance have been updated recently and patient contact shielding is no longer recommended for most imaging settings in dental radiology. It is unclear whether radiology departments at dental teaching hospitals in the UK are aware of these sources of guidance, and how this relates to clinical practice within these departments. A survey was carried out exploring the awareness of current guidelines and clinical practice at dental teaching hospitals in the UK. The survey was sent to a representative at 17 different dental teaching hospital radiology departments. Responses were received from 11 departments. The range of intra-oral and extra-oral imaging carried out at these departments was comparable. Ten departments were aware of the existence of national guidelines for patient contact shielding, however only four were specifically aware of the recent BIR guidelines and only four were specifically aware of the FGDP/PHE guidelines. No department was aware of both sets of guidelines. No departments used thyroid protection for bitewing, periapical, lower 45 degree occlusal, panoramic or lateral cephalometric radiographs. Six departments sometimes or always used thyroid protection for upper standard occlusal imaging. Two departments used thyroid protection for cone beam CT imaging. No departments routinely used lead aprons on patients for dental imaging. In conclusion, radiology departments at dental teaching hospitals in the UK do not use patient contact shielding for most imaging situations in dental radiology. There is mixed awareness of current national guidelines, but the reported clinical practice aligns well with the current guidelines.

1. Introduction

Many dental radiographs are carried out every year in both primary care and specialist services in the UK. Although, individually, these are low dose investigations with a trend towards decreasing dose over time [1], the high volume of images obtained in both adults and paediatric patients means that dental imaging remains an important source of medical radiation dose at population level. In the UK, the overall strategy for radiation protection for dentistry is based around avoiding unnecessary exposures through careful selection criteria and justification, optimization of technique to ensure dose to patients is kept as low as reasonably practicable, and monitoring of local practice against national standards using diagnostic reference levels. This strategy is outlined in the second edition of the guidance notes for dental practitioners on the safe use of x-ray equipment, published by the Faculty of General Dental Practice and Public Health England (hereafter FGDP/PHE) [2], and follows the same general principles which are internationally accepted for medical

exposures, outlined by the International Commission on Radiological Protection [3] and the International Atomic Energy Agency [4].

This strategy emphasises careful selection criteria and justification. In the UK, there are dental specific selection criteria publications for both general dentistry and dental specialties [5, 6].

This strategy emphasises optimization of exposures. Here, radiographic technique is important, for example, the use of rectangular collimation for intraoral radiography can reduce the dose by approximately 50% compared to circular collimation [7]. Similarly, field limitation techniques can be employed in panoramic radiography and cephalometric radiography to achieve marked dose reduction [8, 9]. For cone beam computed tomography (CBCT), dose optimisation can be achieved by a combination of selecting the smallest volume size needed to address the clinical question, selecting appropriate exposure factors and by using a reduced angle of rotation during the exposure [2].

Patient contact shielding is another optimization strategy which can potentially be used to help reduce patient dose. In dental imaging settings the main application of contact shielding is the use of thyroid protection using shields or collars. Thyroid protection has been reported to be an effective way of reducing dose for panoramic radiography, cephalometric radiography, intraoral radiography and CBCT [10–14]. There are also some disadvantages to using shielding, including infection control and the potential for shielding to obscure important anatomy on an image due to artefact. In addition, thyroid collars may interfere with automated exposure control systems [15].

In the UK, there are two sources of guidelines which could be used to help make decisions around using patient contact shielding. These are the second edition of the guidance notes for dental practitioners on the safe use of x-ray equipment, published by the FGDP and PHE [2], and the current British Institute of Radiology (BIR) guidance on using shielding on patients for diagnostic radiology [16] (hereafter BIR). These sources do not recommend contact shielding for most dental imaging situations.

In the UK, dental teaching hospitals are institutions which provide training for dentists, dental nurses and other dental care professionals alongside providing clinical care to patients. It is therefore important that practices taught in these hospitals are current and evidence based. To date, it has been uncertain how dental teaching hospitals use contact shielding in their clinical practice, or how current working practices align with current UK guidelines.

The study aimed to (a) explore whether radiography departments at dental teaching hospitals are aware of current UK guidelines for patient contact shielding and (b) describe current practice in patient contact shielding at dental teaching hospitals.

2. Method

An online survey was developed which aimed to capture information about patient shielding approaches used in dental radiology departments. The survey was drafted by the study authors and piloted with input from radiographers at two different teaching hospitals. A full list of questions asked in the survey is provided as supplementary data 1. Study data were collected and managed using REDCap electronic data capture tools [17] hosted at the University of Bristol.

An eligible department was defined as a dental radiography department based in an institution which provides teaching to undergraduate or postgraduate dental students. To identify eligible departments, dental teaching hospitals in the UK were identified using information published by the association of dental hospitals (dentalhospitals.org.uk), which includes both teaching hospitals and dental training institutes which adopt other models for teaching. Each institution was screened for eligibility by the authors, using information published online and (where required) by making online and telephone enquiries. A single representative (usually the superintendent radiographer) was then contacted at each eligible department with an invitation to participate in the study. This included information about the study and a link to complete the survey anonymously. A total of two reminder emails were sent.

Results were summarized using frequency tables (for binary and categorial responses) and by narrative review and assimilation of comments (for free text responses). No formal statistical tests were performed given the small sample size.

3. Results

Twenty dental teaching institutions were identified in the UK. Of these, three institutions were excluded (one does not have a dental radiography department, one does not teach dental students at undergraduate or postgraduate level, one did not provide information to confirm eligibility either online or in response to email and telephone queries). Seventeen institutions were eligible to participate and were sent an invitation. Of these, eleven completed the online questionnaire.

The departments which completed the questionnaire undertook a similar range of imaging modalities. All departments reported taking a range of intra-oral and extra-oral planar imaging. All departments undertook CBCT imaging.

Nine departments had a written local procedure relating to the use of contact shielding. Ten departments were aware of the existence of relevant national guidelines. However only four departments specifically named the BIR guidelines and only four named FGDP/PHE. No departments named both relevant sources of external guidance.

No departments used thyroid protection for bitewing, periapical, lower 45 degree occlusal, panoramic, or lateral oblique radiographs. Six departments sometimes or always used thyroid protection for upper standard occlusal images. Two departments used thyroid protection for CBCT imaging. Where departments gave a reason for their use of thyroid shielding, the reasons generally reflected a desire to reduce thyroid dose, for example one department used this technique 'when the thyroid is in the primary beam' and another reported being aware that 'various research projects have shown shielding in dental imaging does reduce dose to the thyroid'.

No departments routinely used lead aprons routinely for patients for dental imaging. Five departments sometimes used a lead apron, for selected cases. Where departments gave a reason for their use of a lead apron, the reasons generally reflected a desire to reassure patients rather than any belief in their efficacy, for example departments reported lead aprons were offered 'very rarely', 'if the patient requests', 'if the patient insists' or 'in nervous pregnant patients'.

Carers or comforters may sometimes help patients to have a radiographic examination. Eight departments always or sometimes used abdominal shielding for the carer or comforter. Where departments gave a reason, the most common response was that the carer or comforter needed to be in the controlled area.

Summaries to each question asked are provided as supplementary data 2.

4. Discussion

The BIR guidelines and the FGDP/PHE guidelines have similar recommendations for patient contact shielding in dental imaging settings. Neither source advocates the use of thyroid shielding except where the thyroid gland lies in the primary beam. This may happen in the following situations:

- Panoramic or cephalometric examinations where the field of view extends well below the mandible.
- CBCT examinations where the thyroid gland is included or the field of view extends well below the mandible.
- Intraoral examinations where the thyroid is included in the primary beam. This can happen with upper standard occlusal radiographs/periapical radiographs of the upper incisors obtained using the bisected angle technique.

Neither source recommends the use of lead aprons in dental imaging settings, as the primary beam is never aimed towards the abdomen. However the BIR guidance states there may be psychological benefit of wearing a lead apron if the patient is pregnant.

This survey targeted radiology departments at dental teaching hospitals in the UK. The departments which responded report that they do not use patient contact shielding for most the most common imaging situations in dental radiology, but some departments offer thyroid shielding and lead aprons in selected cases. This suggests that clinical practice at teaching hospitals in the UK aligns well with current UK guidelines. Free text comments suggested a difference in sentiment around the use of thyroid and abdominal protection—whereas thyroid shielding is offered (in selected cases) with an apparent belief in efficacy, lead aprons appear to be offered largely for patient reassurance.

A European consensus on patient contact shielding was published recently [18]. This agrees that patient contact shielding should not be used in most imaging settings but that there are exceptions in dental imaging due the proximity of the thyroid gland and the high number of children examined [18]. It therefore makes the recommendation of 'may use shielding' for both dental intra-oral and CBCT imaging. In practice, we saw that thyroid shielding is more popular for upper standard occlusal imaging (used by six departments) than for CBCT (used by two departments). Dosimetry studies suggest that careful use of thyroid shielding during CBCT imaging can reduce the equivalent dose to the thyroid for some examinations and some authors have recommended the routine use of thyroid shielding in children undergoing CBCT examinations [15, 19, 20]. Two of these papers also suggest thyroid shielding should be used in adults aged up to 50 years of age for CBCT examinations [15, 19].

In the context of current guidelines and literature, it is perhaps surprising to see that most departments never use contact shielding for CBCT imaging. We speculate that this could reflect the additional complexity of using thyroid shielding for CBCT imaging, where the shield may need to be applied after scout imaging has

been obtained, and the BIR guidelines [16] strongly recommend that a medical physics expert is consulted prior to using contact shielding for CBCT imaging. This might also reflect a perceived lack of benefit by operators (for example, if an operator is confident that the field of view does not extend inferiorly to include the thyroid). With increasing use of CBCT (which is a higher dose technique than other dental imaging methods), it may be helpful to learn more about the reasons why contact shielding is not used more widely.

Dental radiography departments differ from other hospital imaging settings and from general dental practice settings in terms of the patient population, imaging modalities and equipment used. We therefore decided to specifically target practices within these departments in the UK. A natural limitation of this approach is that the number of eligible departments was small, and this was also reflected in the small number of replies to the survey. As such, the data from this survey was not suitable for any formal statistical tests and we cannot comment on other areas of practice such as dental surgeries or dental hospitals outside the UK.

5. Conclusion

Dental radiography departments at teaching hospitals in the UK have mixed awareness of current guidelines for patient contact shielding. Most departments could name one relevant source, however no departments named both relevant sources and some were not aware of any relevant source. Despite this, the departments who responded to the survey are selective in their use of patient contact shielding for dental imaging, and reported clinical practice aligns well with current UK guidelines.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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Ethical statement

The study received ethical approval from the Dental School Research Ethics Committee of Cardiff University (decision number 2114a).

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