Hooray for X-rays!

Dental hygienist **Alison Lowe*** explains the finer details of radiography use in dental practice.

An awful lot of x-rays

Dental radiographs are one of the most frequently undertaken radiological exposures in the UK.¹ On average, 19 million intra-orals and 2.9 million OPTs (orthopantomograms) are taken each year. That's an awful lot of x-rays. The effective dose of radiation delivered to each patient is small but the collective dose to the operator is significant because of the large number of radiographs taken.

Repeated and excessive exposure of the same regions of the body to x-rays will eventually bring about cumulative changes and may thus do a great deal of damage. The x-rays themselves do not 'add up' in the body but the slight changes that excessive exposure produces in the affected cells remain, and eventually the cells may be irreversibly altered.² This is one of the reasons why continuing education and training in all aspects of dental radiography is now mandatory, and why all DCPs are required to attend a formal course, equivalent to five hours of verifiable education (core verifiable CPD), every five years covering all aspects of radiation protection.

All DCPs can take radiographs provided they have completed the appropriate training. Since 1993, the 'Core of Knowledge' has been incorporated into the hygienist/therapist curriculum. Dental hygienists and therapists can therefore take radiographs in the role of operator provided they have had instruction to do so from a referrer (usually the dentist). If you

qualified prior to 1993 and haven't already completed the training I would highly recommend it. The physics can be challenging but the training adds another string to your professional bow and removes the inconvenience of asking the dentist to take a set of bitewings

'The training adds another string to your professional bow and removes the inconvenience of asking the dentist to take a set of bitewings when they're treating a patient.'

when they're treating a patient – not only is this annoying and inconvenient to both parties but it also wastes surgery time.

Radiographs in the surgery

Knowledge of the pitfalls of radiation is essential but it doesn't always bear any relevance to our daily practice. It is also very easy to forget the critical role radiographs play in the diag-

nosis of dental disease – I wonder how many hygienists can honestly say they look at each patient's past radiographs before they commence treatment? (If they're lucky enough to have a viewer in their surgery!) It's a habit well worth getting into. Indeed, the value of radiographs to support clinical findings cannot be underestimated. They:

- Show the history of disease progression, allowing us to follow bone levels over time and giving us a basis for comparison with new findings
- Provide objective documentation of clinical findings
- Are important in helping to assess the prognosis of teeth affected by periodontitis, as they give additional information on root length and morphology (especially furcations of molar teeth), which the clinical examination does not provide
- Are invaluable in the detection of sub-gingival calculus and approximal caries.³

Also, whilst periodontal probing and other clinical findings are subjective assessments, radiographs present objective data that two or more clinicians can observe at the exact same time. Even if you're not actively involved in taking radiographs it's always useful to know the most effective techniques and films for diagnosing dental disease. The following have all been recommended.

Horizontal bitewings

The bitewing survey consists of two to four films that show the interdental crest and bone crest of the molar teeth in clenched position. This is recommended for patients with uni-form pocketing less than 6 mm and little or no recession. In early cases of periodontal disease the alveolar crest will appear 'fuzzy' (Fig. 1).

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Vertical bitewings

These are recommended for patients with more than 6 mm pocketing as they offer the best view of the alveolar crest with bone loss. In most periodontal patients, four radiographs of this type can provide a satisfactory overview of the interdental bony defects in the molar regions (this includes retentive factors, such as calculus and overhanging restorations, and ill fitting crown margins which facilitate plaque retention and provide more favourable conditions for the establishment of gram-negative anaerobic microbiota,⁴ which increases the risk of periodontal destruction. Presence of calculus is often indicative of poor oral hygiene and insufficient collaboration on the part of the patient.⁵

Early cases of juvenile periodontitis, and the most severe and advanced types of bone loss (50% or more), can also be depicted with vertical bitewing radiographs. Bitewings also have the added advantage that when they have already been indicated for caries assessment, they offer a means of providing information about bone levels around teeth without the need for an additional radiation dose.⁶

Periapicals

In a complete dentition, a minimum of 14 periapical radiographs is necessary to depict all interdental and interradiacal septa. If the patient has multiple restorations or crowns it may be necessary to supplement the periapical survey with two or four bitewings in order to ascertain any iatrogenic problems (Fig. 2).

Paralleling technique

This technique of exposing radiographs is recommended because it produces standardised films that are anatomically correct and easily read by the clinician. It should be used with periapical films for patients with irregular pocketing, pocketing of more than 5 mm and suspected periodontal/endodontic lesions.

OPT

In an ideal world panoramic radiographs (OPTs/OPGs) would be used as an alternative to numerous intra-oral radiographs because of the dose reduction benefits. However, there are limitations to the fine detail achievable with many panoramic machines. They cannot completely replace the complete dental survey, especially in complex cases. Therefore, they are not recommended for periodontal patients because interproximal areas (where most periodontal problems begin) and abnormalities are easier to visualise when the x-rays pass through the teeth in question. This targeting of the x-ray beam can be achieved better with periapical and bitewing radiographs.

However, even though the diagnostic sharpness of individual periapical radiographs cannot be achieved, the panoramic radiograph is an excellent screening mechanism, especially in patients with a severe gag reflex. It is also much more comfortable for patients with a sore mouth – ie with periocoronitis – and unanticipated anatomic circumstances are often detected (Fig. 3).

Digital radiography

If you work with a dentist who loves gadgets you're sure to have this! Digital radiography provides the benefits of computerisation (time saving) and environmental concerns – there is no need for toxic chemicals and lead foil. Also, the exposure to radiation is reduced by

Fig. 2 Periapical with bone loss

Fig. 1 Left bitewing depicting sub-lingual calculus and overhang on restoration

Fig. 3 OPT showing bone loss

between 50 and 80%. Intra-oral mechanisms include either chips (CCD or CMOS) or phosphorising foils. Digital imaging is virtually free of artefacts, which provides enormous advantages in endodontics and implantology. The only downside is that to get the full benefit you need a monitor in each surgery.

Subtraction radiography

Although not widely used subtraction radiographic methods can detect very small changes in the density of alveolar bone when digitised images of two standardised radiographs taken at different times are subtracted from one another. Clinical trials have shown this

Fig. 4 A lateral ceph was taken here at a 90° angle and it can be seen that the boy had either inhaled or forced a metal screw up his nose and it had become lodged in the maxillary antrum

method to be far more efficient in detecting loss of radiographic density in alveolar bone.

Film holders

Faults such as overlapping contact points, poor visibility of embrasures, foreshortening or elongation of the root can all be eliminated through use of film holders⁷ so if you're still using bitewing tabs change now! The quick blue sensor by Kerr is brilliant for use with digital x-rays.

Record keeping

It is now mandatory for all radiographs to be reported, mounted and stored correctly in the patient's notes (so there's no excuse for having dog-eared radiographs in patients' files!) In addition a quality assurance programme to maintain standards of radiography is also required.

Diagnostic use

Understanding the radiographic image is central to the entire subject of radiography and it's very easy to forget what you've learnt. Radiographs are an excellent visual aid, particularly when explaining bone loss – I always say to patients that a tooth is like a lamppost set in the ground; if you remove the concrete around it the lamppost falls down! However, you do need to know your anatomical landmarks because patients will often ask about certain features. For example, many patients think the

Fig. 5 What's gone wrong here? Well, the patient talked through the entire procedure. This is common in patients with Parkinson's or in young children. This is why it's so important to assess the patient first; you simply can't justify an exposure on a patient who can't tolerate the procedure

median palatal suture (the thin radiolucent line between central incisors) is a fracture; they'll express concern about the spaces around the maxillary sinuses and always ask what the hyoid bone is! If you want to clock up some non-verifiable CPD hours it might be worth digging out some radiographs and testing your knowledge by looking for some clinical landmarks. This is a great team exercise – why not start with the periodontal assessment factors and award points for identifying the following features correctly:

1. Alveolar crest (location)
2. Lamina dura (intact?)
3. Furcation involvement of molars
4. Bone loss (horizontal and vertical).

I'm sure we would all identify caries and bone loss correctly but we may have difficulty recognising the following problems on radiographs:

Attrition

This appears as a radiolucent area on the occlusal surfaces and incisal edges.

Abrasion

This is very common in patients with an over zealous brushing technique and it appears as a radiolucent area around the CEJ. It is very easy to misdiagnose and many clinicians often assume it's caries.

Pulpal sclerosis

This occurs when secondary dentine is laid down; very often it will literally obliterate the pulp and no pulp will be visible on the radiograph. Pulp stones can also sometimes be seen on the radiograph if they're large enough.

Hypercementosis

In these days of recession depression many

more people are grinding their teeth. This sometimes results in excess deposits of cementum being laid down in the apical region. In such cases the roots of the teeth will appear large and bulbous on the radiograph.

Film faults and surprises!

As mentioned earlier radiographs sometimes reveal some unexpected anatomic circumstances. Some classic examples can be seen in Figures 4 and 5.

Conclusion

X-rays are a boon to mankind if used correctly and sensibly and it can be seen that a current set of radiographs is important for periodontal assessment. However, they do have limitations and should therefore only ever be used as an adjunct to clinical periodontal assessment. Existing radiographs should always be used whenever possible and care must be taken to consider the patient's health, safety concerns, medical and radiology history before exposing patients and operators to further radiation.

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