

Contemporary medico-legal dental radiology

B Wright*

*Barrister-at-Law, Brisbane, Queensland.

ABSTRACT

The advent of extraoral radiology in general dental practice has become more widespread since 2000, particularly with digital systems. With this comes a range of medico-legal risks for dentists not adverted to previously.

These risks include a higher than expected radiation dose for some surveys, and the risk of a 'loss of a chance' for a patient whereby the images may disclose pathology not diagnosed by general dental practitioners using OPG and CBVT radiology.

Practitioners need to apply relevant legal principles in deciding which surveys to order and record, and also need to explain to patients the dosages of the radiation that they will likely receive. Practitioners also need to assess whether the resultant survey ought to be interpreted by a radiologist to diagnose any wider pathology with which a general practitioner may not be familiar. Extra caution needs to be used in ordering high dose radiology in paediatric patients. Dentists should not assume patients fully understand the nature of CBVT and MCT, and its risks and benefits. Consideration ought to be given to the volume of CBVT ordered dependent on factors such as patient age, symptoms, history and procedural intent.

Keywords: Legal, radiography.

Abbreviations and acronyms: CBVT = cone beam volume tomography; MCT = medically computed tomography; OPG = orthopantomograms; TMJ = temporomandibular joint.

INTRODUCTION

Prior to 2000, general dental practice radiology was largely limited to interpreting intraoral film-based images. It was normal practice for orthopantomograms (OPGs), lateral cephalography and temporomandibular joint imaging using plane films or tomography to be referred to specialist medical radiology practices, or teaching institutions. Some orthodontic practices recorded their own analogue images.

The introduction of affordable digital equipment allowing sophisticated radiology, with advances in software for dental imaging in recent years has seen the creation and growth in Australia of the dental specialty of dentomaxillofacial radiology. These services include acquiring and interpretation of intraoral digital imaging, orthopantomography, medically-based helical scan computerized tomography (MCT) and cone beam volume tomography (CBVT).

Australian dental practitioners are licensed to both create images as an oral radiographer and interpret as oral radiologists. This paper will address some legal

ramifications of ordering and interpreting images for dental practice and consent in relation to radiology. There are significant risks for patients from the radiation dose as well as benefits from relevant information to be gained from radiology, and both these issues are particularly heightened with reference to extraoral imaging, especially with CBVT.

The legal risk that attaches to the interpreter of large volume tomography (typically for a general dentist using CBVT) will be assessed and the minimization of such risk for dental practitioners who own and operate CBVT equipment, interpret their own CBVT data sets and order extraoral radiography examinations will be discussed.

Licences to take dental radiographs and possess oral radiography machinery vary in each state or territory of Australia. It is worth noting that the national health practitioner registration system did not (and perhaps could not) make arrangements for more consistent regulations in relation to possession and use of radiology machines. The need to register with state bodies with very different regulations is a significant

impediment to the free flow of oral health practitioners from one jurisdiction to another. It is hoped that this inconsistency will be diminished.

LEGAL NATURE OF RADIOLOGY

It is well accepted that when one decides to record a radiograph, despite the fact that there is no physical touching, exposing a patient to ionizing radiation can be deemed to be an assault or battery.¹ Because ionizing radiation is invisible, there is arguably a higher duty that the practitioner must observe in relation to informing patients about radiology compared to other diagnostic services.

Factors that increase this duty compared to other dental treatment include: the extended period between exposure and any presenting pathology; patients' general lack of understanding about ionizing radiation and in particular dosages of different radiographs; the rapid changes in technology with both decreases for some dosages in dental radiology and increases in other forms; and changes in the resultant recommendations for diagnostic protocols.

Unfortunately, as much of legal radiology process and direction comes from the USA, some American legal terms have crept into the Australian health care lexicon. 'Informed consent' and 'standard of care' are two notable examples.

Informed consent is a term specifically disavowed by Australian courts: "... the phrase 'informed consent' is apt to mislead as it suggests a test of the validity of a patient's consent ... Moreover, consent is relevant to actions framed in trespass, not in negligence. Anglo-Australian law has rightly taken the view that an allegation that the risks inherent in a medical procedure have not been disclosed to the patient can only found an action in negligence and not in trespass; the consent necessary to negative the offence of battery is satisfied by the patient being advised in broad terms of the nature of the procedure to be performed."²

By using the term standard of care, there is an erroneous suggestion that there is some omnipresent 'standard' (perhaps more widely accepted because of recently introduced Practitioner Standards and Codes of Practice across various jurisdictions); but the truth is something far less concrete.

The Bolam³ test as modified in Australia by common law and legislation – basically the reference to widely accepted professional practice as a means of defining the particularly appropriate level of care, with some statutory and judicial limitations for extremes of opinion – is what is used to establish a particular standard in a particular individual clinical case where negligence is asserted in the delivery of treatment.

To remove any doubt, the standard of procedural care (as opposed to warning of material risks – such

as radiation dose) can only be decided with an examination of the particular circumstances of each clinical event. It is therefore meaningless to say that, for example, an OPG survey is the 'standard of care'.

In a situation where the proximity of a third molar apex to the inferior dental canal can be better visualized with CBVT prior to extraction, the decision as to whether a CBVT ought to be ordered would surely always be an example of practitioner application of knowledge and skill to the particular circumstance. In such a circumstance, common sense would dictate that a discussion ought to take place with the patient as to the benefits of the extra information gained from the CBVT, compared with the risk of the higher dose of radiation. Of course if the decision is made not to image with CBVT and there is a paraesthesia that ensues after the removal of the tooth, the burden of proof in relation to causation will still sit with the patient. But these questions are often not legal questions. They are better answered by consideration of what ought to be done for the patient. Also, it is clear that merely recording a CBVT will not stop the occurrence of a paraesthesia, it will potentially merely give better information about how to avoid the outcome and give information that is useful in deciding how to execute the extraction, or whether to refer to a more experienced or specialist practitioner. As radiation levels decrease with this imaging compared to an OPG radiograph, the need to address the radiation issue decreases and there is more likelihood that CBVT will be ordered. However, a full volume CBVT might not be appropriate if a small volume CBVT were available.

As CBVT becomes more widely available, there will be instances where a patient may well ask why they were not given an opportunity to have a three-dimensional CBVT radiograph.

Material risk

With similar particularity, valid consent to a radiological procedure can only be determined with the particular procedure and particular patient in mind. To paraphrase *Rogers v. Whitaker*:² "... a dental practitioner has a duty to warn a patient of a material risk inherent in the proposed treatment ... a risk is material if, in the circumstances of the particular case, a reasonable person in the patient's position, if warned of the risk, would be likely to attach significance to it (*objective limb*) ... or ... if the dental practitioner is aware or should reasonably be aware that the particular patient, if warned of the risk, would be likely to attach significance to it (*subjective limb*) ... This duty is subject to the therapeutic privilege (meaning in instances where there is an emergency or other special situation)."

Records

Radiological records belong to the practitioner provider who recorded them or was responsible for recording them.⁴ In most cases this is the dentist or oral radiologist, or interestingly perhaps ultimately the owner of the practice, now that owners are not necessarily practitioners – so that there may be a modern dichotomy of ownership and access.

Of course, now that much radiology is digital many people can apparently own, retain and control images simultaneously. No matter that multiple copies exist, ownership resides with the practitioner and provision of copies need always be done with the provisions of the relevant privacy legislation firmly in mind. Requests for images ought to be provided only with a valid signed request or release form.

Radiographs – like all dental records – ought to be stored for at least 7–10 years past the age of 21, but the community might well expect that permanent life-long retention of records is the norm. Although there is no legal requirement to archive, rather than dispose of records, in this digital age it is advisable to keep all records to assist with future treatment, to defend any negligence claim, or to assist with a request for post-mortem identification.

Radiology versus radiography

Dentistry remains one of the health professions that generally has the responsibility for requesting radiological studies, exposing the radiographs, and interpreting the results, and finally making decisions based on the results and interpretation. The specialty of dentomaxillofacial radiology has grown over the last 10 years through postgraduate training in dental schools in universities where specialist oral radiologists are trained and who provide consultant services, usually in conjunction with specialist medical radiology practices.

Intraoral versus extraoral radiography

Dentists in general practice have always been responsible for the exposure and interpretation of intraoral radiographs, simply because referring these patients to radiological services would make the cost of dentistry much higher. Medical radiology services and the efficiency of their delivery is a significant constraint in general dentistry. In fact, many dental procedures are completely dependent on intraoral radiology and impossible to adequately perform without it; these include endodontics, emergency pain relief and implant therapies.

Extraoral radiology – at first principally OPGs – came to medical radiology imaging practices because of the Medicare rebate that attaches in certain circum-

stances on referral from dental practitioners to the provision of OPG radiology reports.

OPG radiography and radiology and risk

In terms of dosage for dental imaging, the risks for film and digital radiology are low compared to medical radiography. It may be that after a discussion of effective dose for a digital OPG, no further discussion needs to be held if the patient is satisfied with the explanation in terms they can understand. A discussion of comparative doses to background radiation can be useful. The benefit of the information that can be gained by the low dose needs to be explained. Showing patients a de-identified OPG image can also be very helpful in conducting an inclusive risk–benefit analysis. For the general dentist, the main medico-legal risk is lack of diagnosis of pathology that may have been clear to an oral radiologist.

Whilst it is clear that examining intraoral radiographs for detection of decay or periodontal disease in a clinical practice requires a degree of experience and knowledge, often the radiographs are examined whilst treating patients and not with the requisite time and appropriate viewing conditions allocated to the task. Radiographs ought to be reviewed with appropriate lighting and without interruption in the way that radiologists examine radiographs. If intraoral radiographs are negligently read and give rise to an action in negligence (over-treatment of carious lesions, or failing to diagnose a lesion), the overall risk to the patient's general health is quite low and legal consequences correspondingly small. In addition, the ability to prove a diagnosis as correct or otherwise from an intraoral radiograph – digital or film – is based on training that all Australian trained dentists receive in radiography and radiology for their undergraduate education.

When OPG radiographs are exposed and examined, the structures that are included for examination extend far wider than the alveolar processes compared to intraoral radiological surveys. Specifically, the wider tissues can involve malignancies and other pathologies. It seems obvious that unless dentists or radiologists examine the surveys and do so with appropriate time and focus, there will be pathologies that will not be detected and as such legal risks may arise. Obviously, some training in detecting these non-dental pathologies ought to be mandatory.

There is extraoral radiography and radiology training available in relatively few locations and the different jurisdictions across Australia have widely differing requirements for regulating equipment, licenses and installations. This seems driven by the fact that although no Medicare rebate generally attaches to the OPG taken in private dental practice, the ability to see an image and interpret it instantly is a great benefit for

general practitioners. Many radiological imaging practices do not provide digital images as they print films for interpretation, although this is changing gradually. Inevitably, the provision of the images from a radiologist on referral is such that there is a significant delay from the time of referral to viewing of the image, and this will always remain at issue for general dental practitioners.

Non-OPG extraoral radiology

With the development of tomography, radiographic and diagnostic services have expanded. Initially, CT scanners and other tomography were so expensive that they were usually owned and operated by medical radiology imaging businesses. The advent of relatively low-cost CBVT, an increase in competition and an increase in sales and marketing by dental companies, has led to the current situation where dentists own and operate CBVT scanners. The principle medico-legal risks for practitioners operating these machines arise when radiation doses are not fully explained to patients and when the practitioner does not report on or consider the whole data sets and wider areas of exposure, and limit their interest to the area in question. By way of example, if a dentist wishes to place a single implant but captures much more area, they should examine the wider area and not simply the small space where the implant will be placed. Often it is the case that the dentist does not know the dosages the patient receives, and has no training in diagnosing and reporting on the 'non-dental' areas.

Dentists generally either refer patients to radiology providers or use their own machines (usually CBVT) to record data sets and then review the dentally relevant sections of the data set. In machines with large volume capacity, large doses of radiation can be delivered to provide a whole of head exposure, but only a very small amount of the data set might ever be examined and reported upon. In machines with lower volume or operator-adjustable volume, the issues are less serious because the data set is not as comprehensive, and also the dosage is much lower.

This raises the following issues to be resolved:

- (1) Whether the exposure of patients to large doses of radiation is appropriate for the diagnostic purpose.
- (2) Whether dentists are responsible for the review of the whole data set and are therefore additionally responsible for identifying and diagnosing all of the possible findings that are available as a result of that survey.
- (3) Whether dentists and patients know the received effective dose from these machines and who is responsible for managing this in the minds of patients, regulators or tribunals.
- (4) Types of consent to be gained for OPG and CBVT surveys.

- (5) If responsibility is found to reside with dentists with extraoral machines, what minimization of the legal risk and improved patient outcomes can be effected.

Negligence

The two types of likely negligence claims that will arise from oral radiology relate to dosage and failure to diagnose.

Dosage

The tort of negligence is well understood by most dental practitioners and patients. The aspects of the tort that are perhaps most applicable in the current situation of dosage are causation, reasonable foreseeability and warning of material risk.

The causation of an injury needs to be proven. Alternatively, the injury might well speak for itself in that a dosage of radiation that is high initially, and if repeated, could give rise to a claim for damages. Whilst it would not be easy for a claimant to prove injury and causation from CBVT diagnostic imaging, the likelihood would increase with paediatric patients and repeat exposure patients. Australian courts have been reluctant to give damages where causation is complicated in relation to a loss of a chance.⁵

The irrefutable fact is that the operation of CBVT without appropriate regulation and guidance will see a higher dosage of radiation delivered to a patient base as a whole but more particularly to certain individuals.

The issue of reasonable foreseeability (and to some extent remoteness of damage) will be one of fact, and will be determined by retrospective studies in the future. Currently, this is hard to determine and makes a successful suit more difficult.

In 1996 Webb *et al.* found that 50% of patient radiation exposure came from full body CT.⁶ O'Hare surmised that the availability of multislice CT has almost certainly increased the potential for litigation, particularly in paediatric patients who have a two to three times greater likelihood of radiation induced cancer than adults.⁷ Moss and Maclean surveyed 53 scanners and found the effective dose varied by up to 36 fold.⁸ O'Hare cites the lifetime mortality risk from a single CT to a one-year-old child has been held to be as high as 1:550.⁹

As to material risk and warnings, the wider question of ionizing radiation dosages across a person's circumstances would be critical in discussing risk and this would include, but not be limited to, occupation and environmental considerations (long haul airline crew or radiographers would have a different risk profile to that of a city office worker), diagnostic and therapeutic radiation history, and patient age and gender.

In cases of general CT radiology, the risks are greater and the duty to inform is clearer. Cardinal *et al.*

explored the issue of informing patients of risks and benefits of radiological examinations: "In addition to the need to educate patients, studies have underscored the need to better educate referring physicians, demonstrating that referring physicians often have limited knowledge of the radiation dose and associated risks for common radiologic examinations. This is unfortunate, for two reasons. First, this knowledge is relevant for appropriate medical decision making in ordering radiologic examinations. Second, referring physicians are well positioned to initiate patient education on the risks associated with these examinations. Referring physicians often have good pre-existing relationships and well-developed lines of communication. They also should understand the benefits of the radiology examination they are ordering for particular patients and have the opportunity to involve the patients in the decision-making process further upstream. By the time patient education can occur in the radiology department, a patient may have taken time off work and made a long trip to the radiology department, and completing the examination may be a foregone conclusion."¹⁰

This is a practical application of the principle that responsibility for the damages that flow from such a referral do not necessarily sit singularly with the radiologist or the dentist. If a dentist refers a patient for radiology for the investigation of pathology, the more serious the suspected pathology, the higher the duty there is to follow up and check that the patient did have the referred investigation performed. There is Australian authority that the duty of care to a patient extends much wider to the referral and even follow up of patients.¹¹

Failure to diagnose

The issue of failure to diagnose in radiology can be characterized as a loss of chance. However, that loss of chance must be a matter of a determination of probability. In a case about failure to diagnose a breast cancer, it was held that: "A mere material increase in the risk of injury followed by the eventuation of the risk in question is insufficient to establish causation. The plaintiff must establish that it was probable that the risk created by the tortfeasor came home."¹²

In other words, for a loss of a chance, an increase in the risk of a death from, for example, pathology which was undiagnosed from a CBVT, will not of itself be enough to prove that the failure to diagnose caused the patient death. It must be more likely than not that the failure to diagnose substantially caused the death.

However, does a dental practitioner have a responsibility to diagnose other pathology from a CT scan? Does the dentist take on that responsibility by ordering a CT scan that has a volume that is larger than the area of interest?

Friedland's paper contemplates most of these issues – albeit from a US perspective.¹³ It is of guidance and the section on field of view, reproduced below, is apposite to questions of appropriate ordering and selection of field of view.

"One of the issues raised by CBCT is just which anatomical area of the jaws and head or neck should be included in a study. For example, assume one takes a CBCT scan of the fully edentulous maxilla for purposes of evaluating the feasibility of placing implants. Does the image provide sufficient coverage if the beam is collimated (in the vertical) to include just the alveolar bone and only 2 to 3 mm superior to the sinus floor? Or is it necessary to include more of or perhaps even the entire sinus? The general principles of radiology dictate that the taking of films be based on clinical indications and that examinations not be done as part of 'a fishing expedition'."

"The rationale for this is to protect both the individual patient's and the public health from unnecessary radiation. Thus, in the example above, if the patient has no sinus symptoms and no sinus pathology is suspected on clinical examination, there is not a strong argument for including the whole sinus. The answer to how large an area to cover also includes, however, the desires of the treating clinician, although this should not generally override well-accepted principles of radiation hygiene. In the above example, some clinicians may insist on seeing all the way to the orbital floor. Further, some software programs require that certain anatomic landmarks be included since the program uses them as (anatomical) fiduciary markers."

"It is also possible to collimate too narrowly, either accidentally or by design, and thus to exclude structures that reasonably ought to be included. The issue of purposely collimating too narrowly is closely related to the reading or interpretation of the films, an issue discussed in depth below. CBCT machines are increasingly being marketed to private practitioners who are not oral and maxillofacial radiologists. Companies' target market is especially orthodontists and practitioners who place dental implants. These practitioners typically do not have sufficient training to interpret the films beyond the confines of their specialty or daily area of practice. Some practitioners believe that one way to overcome the issue of interpretation is to collimate down to the smallest area possible. For example, if an orthodontist does a CT to evaluate an impacted maxillary canine, the idea would be to collimate the beam to include just the tooth and nothing superior or inferior to it. The danger with this approach, however, is that one may miss pathology that is contributing to the noneruption or impaction of the tooth. Similarly, when radiographing the temporomandibular joint (TMJ), if one were to collimate too narrowly, one could potentially miss pathology that is not located

directly on or in the condyle or glenoid fossa, but that is contributing to the TMJ problem. In principle, the anatomical area covered by a CT scan should be no different than would have been covered by a plain-film examination. The extent of the examination should be based on the patient's symptoms and the findings on clinical examination."

Friedland also addressed the issue of responsibility for interpretation: "While there are no legal cases specifically concerning the matter of the scope of interpreting a CBCT scan, the issue can fairly be regarded as settled. A CT is no different than any other image—a dentist cannot read only part of a panoramic film, or only part of a lateral cephalogram. For example, should an orthodontist miss an enlarged sella turcica resulting from a tumor on a lateral cephalogram, the dentist reading the cephalogram cannot offer as an excuse in any legal proceeding that 'I read only part of the film' or 'I read the film only as it relates to the orthodontic diagnosis and treatment'. The dentist is obligated to read all of the film ... Moreover, in determining the standard of care, courts look to what the practice in the profession is, and as is evident from the editorial referenced above, the practice is to read all of the film. Courts are not likely to allow a lower standard of care than the profession demands of itself."

Whilst this is no doubt a fair assessment of the law in the USA, it is by no means certain to be applied in Australia. However, it would be likely to be of significant influence and guidance. The issue of whether patient choice can be involved was also addressed.¹³

"While patients may make treatment decisions, their choices are limited by the bounds of accepted standards of care. No dentist would permit a patient to agree to fill only two canals on a molar tooth undergoing endodontic treatment and then to place a crown because the dentist is unable to navigate the third canal or because the patient can only afford to have two canals filled. Such a scenario would call for a referral to an endodontist or foregoing the crown. The same principles apply to the interpretation of films."

If it is accepted that dentists must ensure that after a wide-area survey the patient has a complete diagnosis, and the dentist lacks the skills and experience to provide this, it is logical that it be referred to an oral or medical radiologist. In the USA, no national dental regulations mean that radiology telemedicine is quite difficult. No such barriers exist in Australia.

It has been established in the High Court case of *Chappel v. Hart*,¹⁴ that when making treatment decisions, there is a responsibility on the treating practitioner to advert as to whether the procedure (in the present case, reading of a radiology image) in the particular circumstances could not be better performed by a more experienced practitioner. As oral radiologists become more prevalent, the onus to refer becomes

somewhat stronger. It may be the case that whether one orders a CBVT survey for dental treatment or not, the patient might well have a reasonable expectation to have interpretation (of all the data available) performed as a matter of right – to reinforce the view of Friedland.

It would seem that if one refers a patient (and/or their image) to an oral radiologist, the responsibility for the expertise in reading and interpreting that radiograph resides with the radiologist. Of course, the wording of the referral will be determinative of where the responsibility lies for which structures and the interpretation of the image in relation to those structures.

Digital and film radiography

In a case discussed by O'Hare, a misidentification occurred subsequent to a death as a result of mislabelling of film radiographs.¹⁵ A body was released when identification was not correct. The importance of these cases is that manual labelling of film after the recording of a radiograph is clearly more prone to error than the conventional digital system whereby a patient's details are entered or selected prior to the exposure of the image.

In addition, the dosages of a properly calibrated and operated digital system are widely accepted to be significantly lower than a comparable film system,¹⁶ despite some reported inconsistencies with systems (*PSP v. Sensor*) and the accommodation of changes by clinicians to digital systems.¹⁷

Increases in resolution in both sensors and monitors mean that there is less reason to persist with film for dental intraoral procedures.

SUMMARY AND RECOMMENDATIONS

- (1) Dentists who refer patients for CBVT and OPGs need to explain the risks of radiation dosages.
- (2) Dentists who record OPGs and CBVT in their own premises with their own machines also need to explain dosages and risks, but with a higher duty than those merely referring.
- (3) Dentists who record OPG radiographs must take responsibility for all non-dental diagnosis from such images or alternatively have them assessed on referral by an oral radiologist or medical radiologist and include this cost in their estimate of fees to the patient.
- (4) Dentists who record small volume CBVT for diagnostic purposes need to make assessments as to whether all of the data set and possible information has been viewed and appropriately interpreted and whether referral to an oral radiologist is appropriate for viewing the data set.
- (5) Dentists who record large volume CBVT (with no variable volume options) in their own premises with their own machines need to refer all data sets to an

appropriate radiologist for review and include this cost in their estimate of fees to the patient. These dentists are at most medico-legal risk.

(6) Dentists should not order CBVT without appropriate individual discussion of dosage related risks for all paediatric patients.

(7) Dentists with their own CBVT machines ought not ordinarily order or expose CBVT for paediatric patients.

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*Brad Wright
Barrister-at-Law
Bennett Chambers
Level 6
107 North Quay
Brisbane QLD 4000*

Email: brad.wright@bennettchambersgroup.com.au