

Point of Care

The "Point of Care" section answers everyday clinical questions by providing practical information that aims to be useful at the point of patient care. This month's answers are provided by speakers at the ODA Annual Spring Meeting held jointly with CDA. For more information on the meeting, see page 913.



QUESTION 1

What is the significance for dental professionals of the recently documented case of patient-to-patient transmission of hepatitis B?

While speaking with dental professionals in recent years, I have found an increasing concern on their part with the potential occupational risk of hepatitis C virus (HCV) and HIV infections, even though clinical and scientific evidence has overwhelmingly shown hepatitis B virus (HBV) to be the most infectious bloodborne pathogen. The success of dental infection control practices over the past 20 to 30 years, especially vaccination of health care workers, safer handling of contaminated sharps, and routine use of gloves, masks and eyewear, has changed how some health care workers perceive HBV. As a result, many health care providers have turned their attention to other infection control issues, such as contamination of the water in dental units and environmental asepsis. This shift in thinking is not surprising, given that the last instance of dentist-to-patient transmission of HBV was reported by the Centers for Disease Control and Prevention (CDC) in 1987.¹ In contrast to the situation for medicine, where sporadic HBV outbreaks continue to occur, dentistry has a good record for safety with regard to transmission of HBV and other infectious diseases. Unfortunately, a recent report by Redd and

others^{2,3} has brought HBV back to the forefront of attention among dental practitioners. The following discussion highlights the major aspects of this unusual case and considers its implications for dental professionals.

Frequency of HBV Transmission in the Dental Setting

The recently reported case, summarized below, is the only proven instance of patient-to-patient transmission of a bloodborne pathogen in a dental setting and the first documented transmission of HBV to dental patients since 1987. Earlier investigations of HBV transmission in dental practice settings, carried out in the 1970s and 1980s, demonstrated that some dentists had unknowingly infected patients with this resistant virus, which is able to remain viable for up to 7 days in blood outside the body (**Table 1**). Since then, adherence to infection control practices, including vaccination of health care workers, has been extremely successful in preventing dental transmission of HBV; in contrast, sporadic reports of viral transmission in medical facilities continue to appear.

The Case

A 60-year-old woman had 7 teeth extracted in a single visit to an oral surgery office in October 2001. She had no risk factors for HBV infection, and had not been vaccinated against HBV. She began to exhibit symptoms of HBV infection in February 2002, but subsequently recovered. This acute case of HBV infection was reported to the New Mexico Department of Public Health in April 2002. Subsequent investigation determined that the source patient was a 36-year-old woman who had undergone extractions by the same oral surgeon and clinical staff in a procedure that ended 161 minutes before the second one began. The younger woman, who had been an HBV carrier (positive for hepatitis B surface antigen and hepatitis B e antigen) since at least 1999, had had a high viral load at the time of the oral surgery. However,

Table 1 Reports of patients infected by dentist carriers of hepatitis B (United States only)

Year	No. of patients infected	Type of practitioner
1974 ⁴	13	General dentist
1975 ⁵	0 ^a	General dentist
1976 ⁶	37	Oral surgeon
1976 ⁷	15	Oral surgeon
1977 ⁸	55	Oral surgeon
1981 ⁹	3	Oral surgeon
1981 ¹⁰	6	General dentist
1982 ¹¹	12	Oral surgeon
1983 ¹²	4	General dentist
1986 ¹³	26	General dentist
1987 ¹	4	Oral surgeon

^aNo overt symptomatic infection.

she did not self-identify as an HBV carrier to the oral surgeon or staff in the oral surgery office. The 15 practice employees were tested for HBV, and 14 of them had evidence of HBV vaccination. None of the 15 employees demonstrated serologic evidence of prior HBV infection. Using molecular epidemiologic techniques, the public health department determined that this was the first instance of HBV transmission from one patient to another in a dental setting.

Infection Control in the Oral Surgery Office

CDC investigators visited the office on September 26, 2002, and observed several regularly scheduled procedures. The investigators reported that the facility was modern and clean, with appropriate anesthesia and infection control practices in place. Standard infection control practices were followed during the observed procedures, including appropriate hand asepsis, anesthesia, and operation and monitoring of the autoclave. Gloves, masks and gowns were changed between appointments. Plastic barriers were used on high-touch surfaces and were changed between appointments. After removal of these barriers, the surfaces were sprayed with an intermediate-level disinfectant. For all of the patients treated in a single morning, fresh, sterile instruments were used; no instruments were used in common among procedures. In addition, there was no evidence of viral transmission related to the use of multidose vials during oral surgical procedures.

Presumed Mechanism of Transmission

In the absence of definitive evidence of cross-infection, the CDC investigators could only speculate on the mechanism of transmission. HBV is a hardy virus that can persist in dried blood for up to 7 days, and infectious virions can remain on surfaces even in the absence of visible blood. One possibility expressed by the investigators was that cross-contamination might have occurred by means of an environmental surface. For example, a lapse in environmental aseptic procedures following treatment of the source patient or contamination of non-operative surfaces by the source patient might have set the stage for subsequent cross-infection.

Written discussion of the case also mentioned the role of vaccination against HBV in preventing disease. Susceptibility to viral infection is necessary for transmission. HBV vaccination programs in place since 1982 have effectively reduced the numbers of susceptible health care workers and

therefore the numbers of HBV infectious personnel. If the source individual and the index patient had been vaccinated, this incident would probably have been avoided. In fact, the confirmed HBV immunity of the office staff and other patients treated on the day of the transmission event was probably an important factor in preventing further viral transmission in that dental facility.

Conclusions

The unfortunate transmission of a life-threatening disease, HBV infection, was recently reported to have occurred in a dental practice. The rarity of the event attests to the overall success of infection control practices in place today. Its occurrence, however, is a reminder of the necessity to perform everyday cleaning, disinfection and sterilization consistently and correctly. This case reinforces the principle that standard infection control precautions may be effective at minimizing the potential for cross-infection, but they do not necessarily eliminate all risks. Redd and others² speculated that contaminated environmental surfaces might have been the mechanism of transmission of HBV in this case. They also suggested that universal HBV vaccination should be extended to cover presumed "low-risk" individuals, in addition to children, health care workers and those in other high-risk categories. ♦

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Dr. Molinari's presentations at the joint ODA/CDA meeting, titled "Fighting the flu: respiratory infections and protection" (morning session) and "Update on vaccine recommendations" (afternoon session), will be presented on Thursday, April 10.

QUESTION 2

What part of the patient record from a general dental practice is most useful for identifying the victims of disaster through forensic odontology?

The clinical diagnostic and treatment records of dentists have many uses in a wide variety of legal contexts, but few such situations are more important than those in which we are asked to supply antemortem data for missing persons who might be our patients. When people participate in high-risk activities that result in death or are caught in natural or human-caused disasters, dental records can be an important source of comparative data to establish the identity of recovered bodies. The release of antemortem data by dentists goes far beyond the scope of routine practice and emphasizes the significant societal role that practitioners can play on behalf of Canadian citizens. Increasingly, as dentists learn about the role of forensic odontology in mass casualty incidents, questions arise about the aspect or aspects of a patient's record that are most useful for the purposes of identification and thus the records that should be released to authorities in these circumstances. This article aims to provide insights about how clinicians can determine which records to release so as to provide the most up-to-date and useful data for forensic identification.

Human Identification Based on Dental Features

Human identification by means of the teeth is based on the premise that each person's dentition contains a collection of unique characteris-

tics, either because of custom-made restorations or because of the numerous anatomic traits that collectively represent the person's unique data set. In some people, especially those who have experienced minimal or no restorative intervention, a combination of these 2 data sets may be needed for comparison at autopsy.

Restorative treatments are considered to provide the best basis for comparative identification. That is because dentists extend cavity preparations, the margins of fixed prostheses and other hard-tissue interventions to encompass decay, fractures or other clinical problems that are specific to the particular patient. These unique extensions are visible on radiographs. If you imagine the shapes of these restorative treatments as 3-dimensional objects separate from the tooth, and then consider the projection of these shapes onto 2-dimensional radiographic film, the resulting radiographic image of the object provides a unique 2-dimensional shadow for forensic comparison. **Figure 1** illustrates the use of the shapes of dental restorative treatments for identification purposes. In the case of a partial or complete removable prosthesis or appliance, the most important way a clinician can assist in any future forensic investigation is to instruct the laboratory to insert the patient's name in the acrylic of the device.

Normal variants in the shape and size of anatomic structures and various presentations of



Figure 1: Comparison of antemortem and postmortem bitewing radiographs to establish identification. The film on the left was exposed during the patient's recall exam on January 16, 2007. The film on the right was exposed at autopsy on October 3, 2007, on a body found in a lake.

common morphological traits, taken in combination, also produce a unique collection of identifiers for each individual. Traits such as curved or dilacerated roots, pulp stones, accessory root canals, supernumerary teeth, patterns of alveolar bone trabeculae, periapical inflammatory lesions, periodontal defects and osteomas are not uncommon in the general population. However, when a number of these traits appear together in one person's mouth, the combination of identifiers is usually sufficient for the purposes of forensic comparison.

The "Best" Forensic Dental Record

Thorough, detailed and comprehensive dental treatment records that document all aspects of the treatment modality provide the best data for comparative purposes. Details of the restorative materials used; the type, location and length of the retentive pin or post; the shades and moulds of prosthetic teeth; and notes about unusual findings or treatments are but a few examples of traits that have been crucial to successful identifications.

The "best" aspect of the dental record to release for comparison with postmortem data recovered from an unidentified body depends on what part of the dental complex is recovered after death. For example, if only part of the victim's jaw is found, then only data from that aspect of the antemortem clinical record is needed. However, at the time a person is reported missing and the authorities arrive at the dental office requesting antemortem data, the type of postmortem data that will eventually become available is not usually known. Thus, there is no way to predict which aspect of the missing person's dental record will be most useful. In fact, *all* aspects of the dental record are potentially invaluable; therefore, all clinical records in the dentist's possession (including working casts, laboratory set-ups, appliances, spare prostheses, but excluding accounting and financial details) should be released to authorities.

Most importantly, only original dental records should be provided for forensic use. This recommendation runs contrary to the belief of most clinicians that they should never release original data to parties outside the practice. The forensic identification of human remains is an acceptable reason for such release. The original records should be duplicated before their release, and these duplicates should be kept on file in the dental office. The clinician should obtain a signed and dated receipt from the authority collecting the original records,

which will be returned to the dentist on completion of the identification process.

The importance of original records in a legal context cannot be overstated. For example, the right-left laterality marker (dimple) that appears on intraoral radiographic films is not visible on duplicate films, so this orientation information is lost when films are copied. Similarly, photocopied charts do not contain the often-crucial multicoloured notations appearing on original documents. These issues are of considerable concern and underscore the potential value of any and all data and the impossibility of predicting what dental information will be recovered and available after a person's death.

In the final analysis, all original documents, radiographs, photographs, appliances and casts, along with any associated materiel that records the dental status of a missing person during their lifetime, are crucial to successful identification of human remains. ♦

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Further Reading

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Dr. Sweet's full-day session at the joint ODA/CDA meeting, titled "One dentist's role in helping to solve murders in Canada!" will be presented on Friday, April 11.

QUESTION 3**How can I protect my practice from complaints and malpractice claims?**

Risk management is not new to dentists or other health care professionals. The principle of “do no harm” has been entrenched in medical practice since the times of the Hippocratic oath. That is why, over the years, dentists have adopted risk management principles such as infection control, informed consent, and accurate and complete documentation. To ensure to the extent possible that patients are satisfied with the dental services they receive and that these services are provided in a safe, competent and ethical manner, dentists can implement the following 6 key principles, which will go a long way toward preventing complaints and potential legal action.

① Keep Good Records

Bad things can happen to good dentists because of poor records. In fact, a problem with record-keeping is often the primary reason why a dentist cannot be defended in a malpractice claim.

Make sure your records are detailed and accurate, and are maintained for the required retention period in your jurisdiction. In Ontario, for example, records must be maintained for at least 10 years after the last entry; for children, the retention period is 10 years after the child reaches the age of 18.

The following guidelines cover most types of dental records:

- Entries should be dated, written in ink, and signed or initialled.
- Radiographs should be labelled and dated, and the radiographic findings documented in the patient’s dental record.
- Medical histories should be complete and up to date.
- Each patient’s record should contain a diagnosis and treatment plan.
- Progress notes should be detailed and accurate.

The importance of recording a diagnosis for every patient and every procedure cannot be overemphasized. In Ontario, dentistry is one of a handful of regulated health professions and the only regulated dental profession that, by virtue of practitioners’ educational background and professional training, has been given the privilege and legal right of diagnosing and communicating a

diagnosis to our patients. As dentists, we need to take this responsibility seriously and ensure that each and every patient record contains a diagnosis and a well-thought-out treatment plan based upon that diagnosis.

Diagnosis is also a key element of the informed consent process, which is discussed in the next section.

② Always Obtain Informed Consent

Take the time to provide your patients with sufficient information to allow them to make an informed treatment choice. Six key elements must be covered in the informed consent process:

- diagnosis
- nature and purpose of the recommended treatment
- benefits and risks of the recommended treatment
- treatment alternatives, including their risks and benefits
- consequences of no treatment
- cost of the recommended treatment.

It is also important to document details of the informed consent dialogue. Consent is usually obtained verbally, but the fact that it was obtained should be documented in writing. Many dentists like to use consent forms, and these can be helpful. If a form is used, it should include a paragraph, to be signed off by the patient, stating that she or he has read and understood the form and has had an opportunity to ask questions. If these 3 things have occurred, then informed consent is typically deemed to have been obtained.

Practitioners should be aware, however, that a signed consent form on its own is not evidence that informed consent was obtained. The best evidence is documentation in the daily record of the discussion of the key elements (e.g., “I.C. discussion as per consent form for extraction of wisdom tooth”).

③ Make Excellent Communication a Priority

Most patient complaints and lawsuits incorporate some element of poor communication. Despite your best efforts, communication lapses can and will occur; therefore, make an extra effort to ensure that checks are in place to minimize

problems in your dialogue with patients, in your discussions with staff and when speaking to colleagues as part of the patient referral process.

④ Develop Strategies for Preventing Mishaps

Procedural mishaps that can happen in dental practices include treatment of the wrong tooth, ingestion or inhalation of instruments or materials, and burns, cuts or abrasions to the soft tissues. Although such mishaps are not usually considered to represent negligence, they may lead to patient injuries. Various strategies are available to minimize such incidents in your practice:

- Make sure the patient's current radiographs and records are available at each appointment.
- Ensure that the treatment being contemplated is appropriate for the problem.
- Use a rubber dam whenever possible.
- When it is not possible to use a rubber dam, consider protecting the throat with gauze.
- Ensure that patients wear safety glasses.
- Ensure that office staff are aware of safety-related information for the various materials used in the practice.

Even with preventive strategies in place, mishaps may still occur, and it is important to remember that what a dentist does after the occurrence of such an incident is often as important as the incident itself in determining what happens next. It is crucial that patients be informed when untoward mishaps occur and the appropriate corrective action or referral takes place.

⑤ Recognize Your Limitations and Treat within Your Comfort Level

When patients seek dental services, they have a right to expect that they will receive appropriate, competent and up-to-date dental care. Even if you do not realize it from the outset of a difficult procedure, you will soon find out if you are "in over your head" when treating a patient whose needs are beyond your competencies. When this occurs, you must take appropriate action to resolve the issue, such as referring the patient to a more experienced colleague or a dental specialist. However, it is preferable to be able to recognize your limitations before undertaking any procedure.

When a treatment outcome is unfavourable, one of the most common allegations made by the patient is that the treatment was beyond the dentist's scope of practice and that the patient should

have been referred to a specialist. Therefore, you should develop relationships with the specialists in your area, and you should not hesitate to refer difficult cases for a second opinion or for treatment. Again, communication is key.

⑥ Personally Review Records from Your Practice before Transferring Them or Sending Accounts to Collection

Dentists are legally required to comply with a patient's request to transfer records, but such records may include personal information that the patient would not want revealed to anyone else. For example, a teenager who confided that she was taking birth control pills or was being treated for a sexually transmitted disease may have asked that this information not be shared with others, especially her parents. In such a case, and in light of the fact that most dentists prefer to obtain a new medical history themselves, you may choose not to provide the medical history to the new dentist.

Before sending a patient's account to collection, it is advisable to review the file to find out if the results of treatment were less than desirable or if the patient has already expressed dissatisfaction. Many patients who are unhappy with their treatment are initially reluctant to file a complaint or a claim against a health care provider. However, when the patient leaves the practice, sending the account to collection or instituting an action in small claims court to collect the outstanding balance may be the last straw for the patient, who may file a counterclaim. ♦

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Suggested Reading

RCDSO's *Dispatch Magazine* (www.rcdso.org/pubs_resources/publications/dispatch.html)

The *Risk Management Guide* of the Professional Liability Program (www.rcdso.org/prof_liability/risk_management.html)

On Thursday, April 10, senior RCDSO staff will be presenting the seminar "Staying safe in your dental practice" at the joint ODA/CDA meeting.

QUESTION 4**Where does cone beam computed tomography fit into modern dental practice?**

Cone beam computed tomography (CT) is a novel digital imaging modality that uses a rotating x-ray source and a single-panel detector (**Fig. 1**). Cone beam CT is unlike the CT found in most hospitals, in that the patient remains stationary during image acquisition. However, the result of the 2 modalities is similar: acquisition of a 3-dimensional volumetric set of image data for the region of interest. These data can be reconstructed and viewed as thin-slice images in multiple planes or rendered 3-dimensionally (**Fig. 2**).

The first application of cone beam CT in oral and maxillofacial radiology was described in 1998,¹ and since that time, a number of systems have become available worldwide. Each is unique, differing in size (including diameter) of the imaging volume, resolution and radiation dose. Imaging volumes range from small cylindrical-shaped volumes measuring 3 cm (diameter) by 4 cm (depth) to large spherical volumes measuring 30.5 cm in diameter, with smaller-field-of-view systems producing higher-quality images. Radiation doses also vary between systems, ranging from 59 microsievert (μSv) to 599 μSv (3 to 28 times the dose associated with a panoramic radiograph).^{2,3}

The Uses of Cone Beam CT

Many believe that new technologies supersede older ones, with the older technologies becoming obsolete. This is not the case for cone beam CT.

This modality should be viewed as an addition to the diagnostic imaging armamentarium of dentistry. Image quality and the higher radiation doses associated with cone beam CT are 2 of the factors that may ultimately limit its use in dentistry. However, when advanced imaging is required, it may be the modality of choice for evaluating osseous temporomandibular joint anatomy (**Fig. 3**), localizing impacted teeth (**Fig. 4**), performing the investigations needed to plan dental implants (**Fig. 5**), and diagnosing and monitoring oral and maxillofacial diseases (**Fig. 6**). As a result of its unique capabilities for multidimensional reformatting, other potential applications of cone beam CT include investigations of the paranasal sinuses, assessment of palatal clefts and investigation of oral and maxillofacial trauma.

The Limitations of Cone Beam CT

In addition to issues of image quality and radiation dose, a third major limitation of cone beam CT relates to management of the image data. In medicine, radiographic images are reported by radiologists, who accept liability for the findings. For the most part, however, dentists act as their own radiologists. As such, they are responsible for interpreting normal anatomy, anatomic variants and pathoses depicted on images of their own patients, unless the images are interpreted and reported by a second party, such as an oral and



Figure 1: Cone beam computed tomography system showing the x-ray source (to the left of the model) and the receptor.



Figure 2: Axial or transverse (top left) sagittal (middle left) and coronal (bottom left) images, and a 3-dimensional rendering of a patient's image data (right).

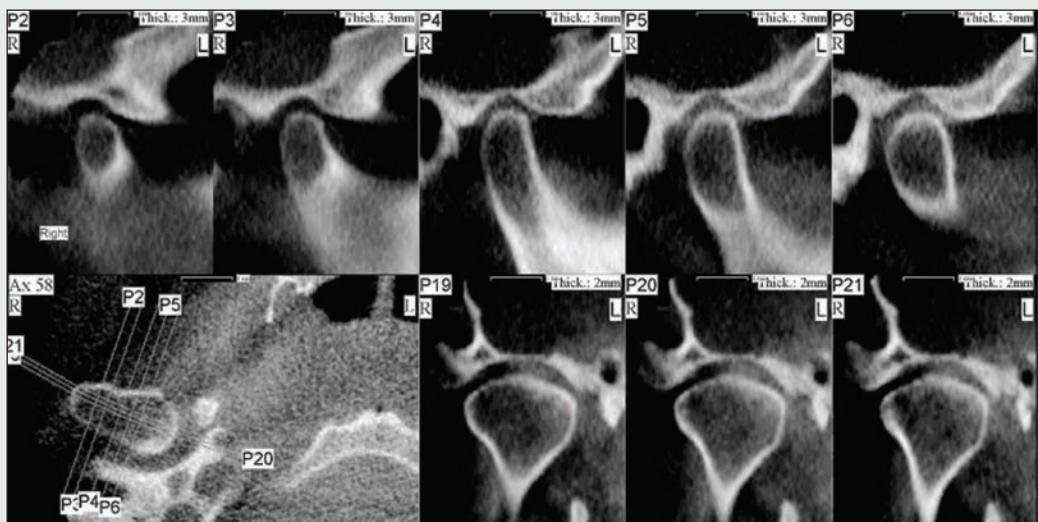


Figure 3: Sagittal (top row), axial or transverse (bottom left) and coronal (bottom right) images through a normal temporomandibular joint.



Figure 4: Oblique reconstruction along the axis of an impacted maxillary canine.



Figure 5: Buccolingual cross-sectional image through an edentulous mandible. A radiopaque marker (overlying the mandible) shows the proposed site of implant placement.



Figure 6: Pseudopanoramic image through the left hemimandible demonstrating sclerotic and periosteal new bone formation, an appearance consistent with osteomyelitis. The image was generated along an arc defined by the curvature of the mandibular body. This image is not, however, directly comparable with a traditionally acquired panoramic image.

maxillofacial or medical radiologist. Although the anatomic region depicted is limited with small-field-of-view cone beam CT systems, systems with larger fields of view encompass radiographic anatomy that may be unfamiliar to many dentists, for example, the paranasal sinuses, the skull base, the tympanic cavity, the cranivertebral junction and the cervical spine.

In response to recent interest in cone beam CT systems in orthodontics, the editor-in-chief of the

*American Journal of Orthodontics and Dentofacial Orthopedics*⁴ has commented that "It only makes sense that, as specialists in orthodontics, we understand when to refer our patients' [cone beam CT] scans to specialists in radiology — for the best possible care." Fortress Insurance, a company that provides professional liability insurance for dentists in the United States, states that "the dentist has a responsibility to read the entire film, or have it read by a radiologist."⁵ Moreover, for

jurisdictions where patients are given the option of absolving the dentist of liability for failing to interpret abnormalities outside of a specified area of primary interest, Fortress opines that “[the dentist] cannot have the patient sign away liability.”

Presumably, patients undergoing diagnostic testing, including cone beam CT, do so because of a specific finding in the medical or dental history or because of a clinical sign or symptom that requires investigation. Recently, Cha and others⁶ reviewed the findings of 500 mainly orthodontic and implant patients who underwent cone beam CT. Incidental findings, mainly airway or sinus-related abnormalities, were identified in 24.6% of patients. Of the 252 orthodontic patients, only 8 had reported a previous medical history of allergy, asthma or sinusitis, and only 4 had reported a previous history of temporomandibular joint symptoms. Thus, although the frequency of abnormal findings may be small and most of the abnormalities benign, the results of this study indicate a clear and timely need to develop ordering guidelines for cone beam CT, such that the burden of radiation dosing to patients is kept as low as reasonably achievable, particularly for children and adolescents.

Cone beam CT has revolutionized imaging in oral and maxillofacial radiology, and oral and maxillofacial radiologists are excited about offering our expertise in multidimensional imaging to the dental community. ♦

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Dr. Lam will be presenting 2 sessions at the joint ODA/CDA meeting on Friday, April 11: “Risk vs. benefit: the ins and outs of radiologic decision making” (morning session) and “Principles of image interpretation” (afternoon session).

The responses in the “Point of Care” section reflect the opinions of the contributors and do not purport to set forth standards of care or clinical practice guidelines. Readers are encouraged to do more reading on the topics covered.