Image comparison versus written records in forensic odontology: a matter of confidence

Alex Forrest[1] & Veronika Valena[2]

[1]Forensic Odontologist, Queensland Health Forensic and Scientific Services, 39 Kessels Rd, Coopers Plains, Qld 4108, Senior Lecturer in Forensic Odontology, Griffith University, Nathan, Qld 4111
[2]Forensic Odontologist, Queensland Health Forensic and Scientific Services, 39 Kessels Rd, Coopers Plains, Qld 4108

Abstract

The purpose of comparison of records of a missing person with those derived from examination of a deceased person is to establish the identity of the deceased. The certainty of the conclusion has significant consequences in terms of the outcomes for families, investigators, coroners and the administration of justice.

We discuss the issues relating to the use of comparison of images deriving directly from individuals as opposed to comparison of written dental records in routine forensic odontology identification, and analyse the pattern of use of images in routine Queensland forensic odontology in response to the changing forensic environment between 1994 and the present.

1

Written Dental Records

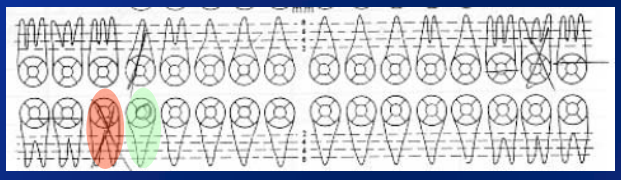
Is a picture worth a thousand words? In the case of dental records the answer will almost always be "yes". Written dental records can be extremely difficult to manage. Mostly, they are handwritten, so an ability to interpret poor handwriting is a good skill to have. Dentists tend to write using professional jargon, often shortened to cryptic acronyms. Many of these are standard across a large proportion of the profession, but dentists tend also to develop their own "shorthand" which aids them in writing in a busy practice. This can make dental records extremely difficult to interpret, even by other dentists, and especially if we are not provided with the contact details of the dentist by an investigating police officer so we can confer directly with them.

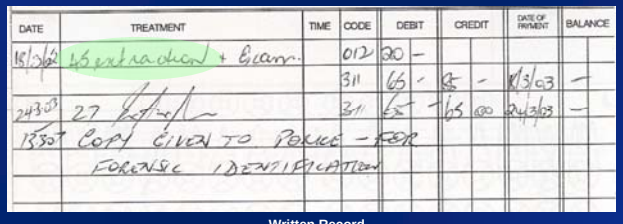
Owing to increasing patient mobility, many patients visit several different dentists during their lives, and so dental records that are retrieved may contain only partial (and possibly outdated) information. Most dentists do not record a complete survey of their patients' dentition at examination due to the time constraints operating in a busy practice, which is, after all, a business. Further, should records be obtained from overseas, they may be in an unfamiliar language.

Because records are written by humans, they are prone to error. And all use of professional jargon is subject to individual interpretation, especially that used to describe fillings. All of this renders written dental records a subjective, often incomplete, basic account that is open to interpretation, and certainly contains little information about the detailed characteristics of individual filling and tooth morphology. These constraints prevent us from using them to definitively confirm identification unless extraordinary evidence is contained within them (Figure 1).

2

Odontogram





Written Record

The odontogram (tooth diagram) shows the lower right first molar tooth highlighted in red, (tooth 46) has been removed as indicated by a cross drawn through it. The written record shows that tooth 45, the lower right first premolar tooth, marked in green, has been removed. The corresponding tooth on the odontogram is also marked in green. Without an image of the teeth from a treating dentist to determine the issue, this problem cannot be resolved. *This* written record cannot identify a person.

Can we be sure other written records do not contain errors that are more difficult to observe?

Figure 1. Red and green highlights added by the authors.

3

Images and Other Records

Images of the dentition may include photographs or radiographs, and unlike most written records, they form a complete and objective snapshot of the teeth that are recorded at the time the image is acquired. They may also feature an entire constellation on individual detail, including relative sizes and shapes of teeth, dental restorations, bone contours and anatomy, and other items, depending on the type of image available. Other dental records such as dental study casts are models of a set of teeth, and mouthguards and other dental appliances may also provide information that can result in a model being made, with subsequent imaging taking place. Such images offer a wealth of individuating detail that is simply not available in the written dental record and can be objectively compared with a deceased dentition.

4

Image Comparison and Image Superimposition

Depending on the types of ante-mortem images available, the forensic odontologist may choose to compare them with post-mortem images, or to superimpose them, to demonstrate that they were derived from the same person. The examples below illustrate comparison of radiographs (Figure 2), superimposition of a dental model and original teeth (Figure 3), and a radiographic superimposition (Figure 4).

With the comparison of the entire spectrum of available minutiae, the degree of confidence in the extent of the similarity is enhanced to a degree simply not possible with written records. Additionally, image comparison can be understood and evaluated by the non-dentist, so the scientific basis of the comparison and consequent opinion is made accessible to a lay audience. This helps to satisfy the Basis Rule of expert evidence.

The percentage of cases in each period between 1994 and August 2008 in which advice of confirmation of identity using images was provided in Queensland is shown in the table below. We now provide such advice without images only in compelling cases where unusual and diagnostic features are present in the written record.

1994/1995	1996/1997	1998/1999	2000/2001	2002/2003	2004/2005	2006/2008
77%	84%	79%	81%	86%	94%	96%

5

Post-Mortem radiograph from deceased

Both these radiographs are from the dentist of the unknown missing person, Ante-Mortem

Figure 2.

Image Comparison

Comparison between the two ante-mortem radiographs and the post-mortem radiographs reveals a similarity that extends to include details of the shapes and sizes of the teeth and the dental restorations, providing evidence that such similarity is unlikely to occur on a chance basis. We can express the opinion that these images derived from the same individual.

6

Figure 3.

Image Superimposition with Study Cast

Superimposition of a photograph of the teeth of a deceased person and a dental study cast obtained from the treating dentist demonstrates the high degree of similarity between the morphological features of both.

A similar comparison between the photograph and the study model of the upper teeth reveals a similar degree of similarity.

While a measurement scale is absent, we can observe that this comparison of morphological characteristics is more satisfactory than comparing written notes.

7

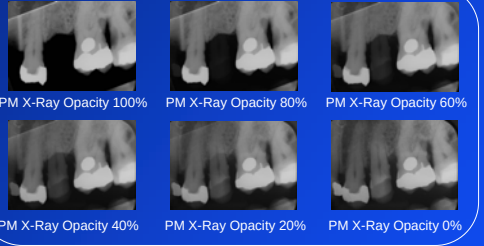


Figure 4.

Radiographic Superimposition

Superimposition of a radiograph of a deceased person over the corresponding radiograph of a known missing person demonstrates a high degree of correspondence in all respects (tooth 25 was extracted in the written record). This degree of similarity is unlikely to occur as a matter of random chance.

We can express the opinion that these images derived from the same individual.