Abstract
Identification by means of dental comparison between records of a missing person and the dentition of a deceased individual depends on recognition of consistent features common to both with no unexplained discrepancies. Individual root-treated teeth possess a constellation of distinctive radiographic features that provide excellent opportunities for analysis in this context. Root canal treatments rely heavily on radiographic imaging as part of the procedure, and require the taking of a post-treatment radiograph to confirm the result. This means that there is almost always an ante-mortem radiograph which can be used for comparison with a similar image of the post-mortem case, providing the certainty that arises from using images derived directly from the individual rather than written dental records.

We discuss the principles underlying this comparison and illustrate the use of the technique with three cases.

Methods
In a typical forensic setting, the goal of the forensic odontologist is to identify an unknown deceased individual by comparison of their dental features with the dental records of a person thought to be missing following a police investigation.

Written dental records are not the preferred basis of comparison as they are not derived directly from a person. They are merely an index into a record of an event or an observation, which may not be contemporaneous and may have been written in part by a third party. They are prone to errors, inaccuracies and misinterpretation. This quality makes written records unreliable as the sole basis of comparison in dental identification. Furthermore, a statistical basis for identification by comparison of dental features has not been developed.

Images however, are an objective method of recording information; they do not mislead and do not record subjective impressions. In addition, they capture a wealth of specific morphological data that is far richer and more specific than information recorded in a written dental record, making them an excellent basis for a comparison. Radiographs are an excellent example of images that capture the unique morphological features of the teeth, their surrounding structures, and any dental restorations that may be present.

Due to their relative rarity and their unique expression of individual morphological features, root canal treatments are a very fruitful source of features that can be used to differentiate between dentitions and, by extension, demonstrate similarity to a high degree for identification by image comparison. Furthermore, taking an periapical radiograph of treatment to provide a record of the outcome thus providing a post-treatment radiograph that is commonly available as part of the dental record.

The purpose of the comparison process is to establish that these radiographs originate either from the same person (identification) or from different people (exclusion).

The success of the technique is dependent on the similarity of the parameters with which the two images have been taken. Examination of the ante-mortem radiograph reveals information about the environment position, the film exposure, and the relative magnification or distortion of the image. All of these parameters need to be reproduced in the post-mortem radiograph in order to render the two images directly comparable (Case 1 shows the effect of not duplicating the x-ray sensor position accurately). Commonly this necessitates a series of post-mortem images in order to obtain a satisfactory result. Initial inspection of the first radiograph usually allows assessment as to whether the morphology of the root treatment, filling and dental morphology are sufficiently similar that an exclusion cannot be determined at this stage. If the observed morphology is sufficiently similar, then subsequent radiographs are taken to improve image comparability.

Discussion
Following a police investigation in the matter of a routine forensic identification, a missing person will have been tentatively identified as the most likely candidate for the identity of a deceased person. The forensic odontologist is then asked to compare any available dental records of that missing person with the dental features of the deceased to determine if they are both likely to have originated from the same individual.

Thus, the dental features of the deceased are not being compared with the teeth of all other people on earth; this is a one-to-one comparison, and the possible outcomes are:

a) Confirmation: all dental features of both records exhibit correlation with no unexplained discrepancies.

b) Consistency: all dental records exhibit correlation with no unexplained discrepancies, but there are insufficient numbers of features to determine identity beyond possible doubt.

c) Insufficient Information: not enough information exists on which an opinion can be given; and

d) Exclusion: no dental features match those of the known missing person and the dental records of a person thought to be missing following a police investigation.

In Queensland, we will not indicate Confirmation if the two sets of dental records clearly originate from different individuals.

We also introduce a method for determining the presence of root canal treatment by comparison of post-mortem radiographs. This method is based on the assumption that the root canal treatment is sufficient to determine that the two images originated from the same individual, and may add substantially to a case such as case 1, where there is very little other available data.

References:

Root Canal Treated Teeth as an Aid to Forensic Identification
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