Abstract
Identification by means of dental comparison between records of a missing person and the victim 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.

Case 1
The missing person radiograph is on the left, and the image of the deceased is on the right. While a brief handwritten note was the only supplied dental record of the missing person, the radiograph demonstrated the presence of the root canal treatment in the upper left lateral incisor. Without this feature, the similarity between the handwritten note, the supplied radiograph and the post-mortem radiograph would have been insufficient to do more than state that the records were consistent with those of the deceased.

Case 2
The deceased was not visually identifiable following severe incineration. Visual examination of the dentition was not undertaken due to the fragility of the remains. The supplied radiograph of the missing person showed a hand-written note, a radiograph of a periapical size, and a radiograph showing the root canal 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 of distortion of the image. All of these parameters need to be replicated 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 the use of the post-mortem image in order to obtain a satisfactory result. Initial inspection of the first radiograph usually allows assessment as to whether the morphology of the root canal 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.

Case 3
The deceased person was severely putrefied and not visually identifiable. A positive answer to this question permits the objective identification of the unknown deceased person as being the missing person. A positive answer to this question permits the objective identification of the unknown deceased person as being the missing person.

Case 4
The deceased person was severely putrefied and not visually identifiable. A dental record had been supplied by police for a missing person, and comparison of this record with the dental features of the deceased demonstrated complete consistency. A periapical radiograph (left) above was also supplied with the dental record, and it showed the presence of a root canal treatment in tooth 16. The corresponding radiograph of the deceased (right) showed a root canal treatment in tooth 16 with features sufficient to demonstrate that the two images originated from the same individual, providing objective confirmation of the opinion of similarity.

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: the two sets of dental records show significant features of different individuals. 

Following a traumatic injury to the teeth, a person may lose part of the tooth (caries and decay), or suffer from trauma to the teeth. The coronal portion of the tooth moves into the oral cavity from the root, which may be left exposed (the tooth is termed an “EROT”). In Queensland, we will not indicate Confirmation of identity without comparing images, unless extraordinary evidence exists on which a stronger opinion can be given, as we feel that giving an incorrect written dental record does not provide the degree of ignorance needed to assure the reliability of the outcome.

In the ideal case, post-mortem radiographs are taken in such a way that the original conditions under which the ante-mortem image was taken are duplicated as nearly as possible. In such circumstances, similarity between the two images can be demonstrated by superimposition and digital subtraction of common features. In none of the cases presented would this be possible or practical, so image comparison alone is used. Superimposition is not possible in a case such as case 3, in which different types of radiographs are used.

Conclusion
We conclude that root canal treatments provide a wealth of morphological detail, providing rich data for the comparison of radiographs from an missing person and an unknown deceased person to answer the question of whether the two images are derived from the same individual. In those cases presented, the dental features of the deceased were consistent with those of the missing individual, and may add substantially to a case such as case 1, where there is very little other available data.

References:
2. ABFO Guidelines for Human Identification – URL Referenced 21-08-2008: http://www.abfo.org/ID.htm#Categories&TerminologyforBones