Abstract

Comparison or superimposition of post-mortem and ante-mortem dental radiographs is an essential method for identification in forensic odontology.

We demonstrate the use of reformat ted post-mortem CT data to supplement or replace plain film X-rays as a source of post-mortem images for this purpose.

Introduction

Comparison between ante-mortem (AM) and post-mortem (PM) dental radiographs is an established method of identification in forensic odontology (1). Obtaining excellent PM radiographs for comparison depends crucially on having first visualised the AM radiographs, so one can structure an analysis as closely as possible on the parameters of those images.

Situations occur in which maintaining access to the deceased until AM dental radiographs have been obtained is difficult, but without such access, the taking of new (ante-mortem) PM radiographs may result in images that are significantly different from those in the dental records, which may result in a poorer outcome than would otherwise be possible. If you can’t see what you’re aiming to achieve, then sometimes you won’t get the result you require. Such a case is illustrated in Figure 1.

If, however, a high-resolution PM CT Scan of the head of the deceased has been obtained, it may be possible to perform a multi-planar reformat (MPR) of the CT data in such a way as to simulate a given AM radiograph, after access to the deceased is no longer possible.

We illustrate successful application of this technique with two cases.

Case 1

In this case, the PM radiograph (Figure 1a) was obtained before the dental records containing the AM radiograph (Figure 1b) became available. A case exists in the parameters of the AM-PM relationship were therefore not obtained, decreasing the degree of correspondence between the two images.

Because the geometry of post-ante-radiographs is different from that of OPG (orthopantomogram) radiographs, attempts to superimpose the PM and AM are fraught with difficulty. Whereas a visual inspection, that there are differences in the corresponding regions of the images, and we can be certain that they both originate from the same individual?

Clearly, it is better to compare two similar images than two images with different geometries.

Case 2

In this case, it was uncertain that dental records would become available, and a different method of identification was being considered. When access to the deceased was no longer possible, dental examination can no longer be undertaken. However, investigation may still be possible.

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Discussion

When access to the deceased is no longer possible, dental examination can no longer be undertaken. However, investigation may find evidence of dental records some time after the deceased has become available to the forensic odontologist. In such cases, multi-planar reformating of post-mortem CT data may provide views that can be compared with features visible on AM radiographs or which are charted in written dental records, or both. This may permit identification even when the deceased is no longer available to the forensic team for further PM radiology.

The presence of metal restorations plays a major role in forensic dental comparison, not least because these restorations have a specific morphology that can be reproduced on multiple radiographs and accurately compared. Unfortunately, CT MRIs feature artifacts when metal objects are imaged (Figure 2 and 4), which make comparison of this filling morphology difficult when metal fillings are present.

The probability of getting such close anatomical similarities and complete correlation of dental treatments, including their morphology, in two individuals selected at random from the population would be extremely low.

Creating an MPR

A curved line to indicate the plane of the data reconstruction is drawn through the maxillary plane on an OPG. The computer will reform the data to create a view represented by a plane following the course of the cut, which passes through the three-dimensional data set normal to the plane of the drawn path. The thickness of the region on either side of the line can be selected. Although it is clear that both images derive from the same individual.

Comparing the two images shown in Figures 3 and 4 demonstrates a number of correspondences which, together, provide a compelling case for determining that both images derive from the same individual. These include the general tooth root shape and layout across all teeth (although the root of the upper second molar in Figure 4 appear to be slightly more triangular than in Figure 3), the absence of restorative material at the apex of the root of tooth 31, and the presence of a dental implant replacing tooth 26.

In the diagram below (Figure 5), the MPR plane through the mandible is indicated by the red line. In the diagram below (Figure 5), the MPR plane through the mandible is indicated by the red line.