Orthodontic Reconstruction in a Victim of Murder

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Abstract. *Accurate comparison of ante-mortem photographs and the skull of a deceased person is dependant upon suitable superimposition techniques and a post-mortem dentition which is comparable to the situation obtaining in the individual at the time of death.*

The skull featuring in this case presented with a missing upper lateral incisor, lost after death, and the occlusion was studied enabling a replacement tooth to be provided and positioned as in life. Although no dental records were available, good quality photographs of a putative identee were compared by electronic superimposition and the restored occlusal characteristics of the skull were shown to accurately match the photographs of one possible victim. This evidence resulted in positive identification by a Coroner. This case illustrates the importance of seeking specialist clinical advice in forensic dental cases.

Index words: Ante-mortem photographs, Forensic, Orthodontics, Post-mortem Occlusal Reconstruction, Victim Identification.

Introduction

In the early months of 1994 numerous human remains were exhumed in connection with what came to be known as the 'Cromwell Street murders' or the 'Frederick and Rosemary West' case. All the cranial fragments were sent to one of us (DKW) for identification and since, in most of the sets of remains, no dental records were available, facial reconstruction and photographic superimposition was required. Each case demanded different approaches but identification to the satisfaction of Her Majesty's Coroner was achieved in each of the 12 remains presented to the Forensic Dentistry laboratories in Cardiff.

The quality of preservation and exhumation of the skulls was of a high order, and in most cases teeth were intact and available for identification procedures. However, in the case of a young female some teeth were missing, potentially presenting difficulties for comparison with information available at the time of her death. There are very few references to the use of orthodontic expertise in the literature pertaining to Forensic Dentistry (Harris *et al*., 1970; Gysel, 1971; Salzmann, 1974; Hagg and Taranger, 1982) and these do not include individual case histories.

Case History

The skeletal remains of a human being were exhumed on 10/03/94 at 25 Cromwell Street, Gloucester. The post-cranial remains were determined by Professor B. Knight, Forensic Pathologist, to be female, but age at death could not be determined accurately from post-cranial evidence. The skull and mandible were investigated in the Forensic Laboratory in the Cardiff Dental School by one of us (DKW) and the gracile nature of the skull confirmed the sex as female (Fig. 1). Radiographs and photographs were taken and 28 teeth were present in the post-mortem state.

The upper right lateral, lower right lateral, and central and lower left central incisors were missing. All other teeth were present and erupted except that all four third molars were present, but unerupted.

Visual examination of the alveolar socket margins of the four missing incisors indicated that these had been lost post-mortem or very close to death since there was no evidence of any bone remodelling (Fig. 2). Orthodontic opinion indicated that the alveolar socket was labially inclined suggesting that the upper right lateral incisor would, in life, have a markedly labial inclination. There were three amalgam restorations present and there was an occlusal in the lower right first molar; a mesial occlusal and buccal in the lower left first molar; two occlusals in the upper right first molar; two occlusals, and a lingual in the upper left first molar and an occlusal in the upper left second molar.

Radiographs of the skull revealed the presence of partially developed and unerupted third molars and slightly open apices on the lower second molars. These findings, in a female, suggested an age at death of between 15 years and 17 years.

In order to assist with identification, it was decided to 'replace' the missing upper right lateral incisor within the skull. The replacement tooth was fabricated in the orthodontic department by modification of an acrylic 'stock' tooth with due attention being paid to the lateral

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incisor present on the other side. The artificial upper right lateral selected came from a set of Crylopax® (Riverside Dental Manufacturers Ltd, London) '*phantom head*' teeth which have a preformed 'crown' and crudely shaped 'root'. Firstly, measurements were taken of the length and width of the crown of the natural maxillary lateral incisor and used to reproduce, as near as possible, a mirror image of the crown. Next, maintaining the root/crown long axis relationship, the over-large root of the 'stock' tooth was tapered, using a bur, just sufficient to facilitate its insertion into the empty tooth socket in a position in which the socket and crown margin relationship was similar to the standing lateral on the other side. When tightly fitted in to the socket it became apparent that the crown and incisal edge of the replacement tooth was markedly labially inclined and rotated out of the existing dental arch (Fig. 3). All of this orthodontic laboratory work was performed 'blind' without any reference to or with knowledge of, the occlusion of a possible victim.

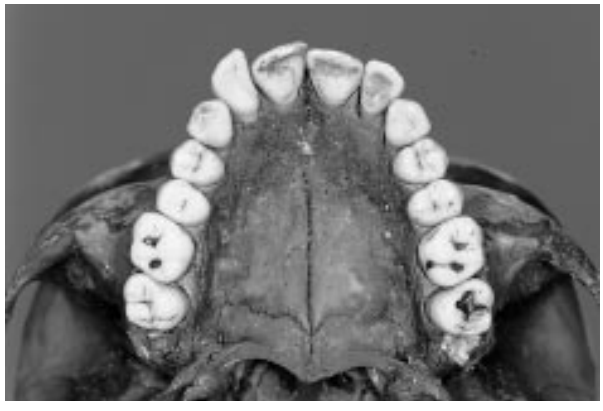
FIG. 1 The smooth, gracile nature of the muscle attachment areas, the shape of orbits, and the supra orbital ridges confirm the sex as female.

FIG. 2 The socket margins of the missing upper right lateral incisor indicate loss around or after death.

Comparison with Ante-Mortem Information

No dental records were available. However, by this stage of the investigation a putative name for a girl of the correct age and missing for the required length of time became available. The step-parents of this person were able to state that she had a front tooth displaced towards the lip. In addition, there were able to say that it was a 'central tooth, but to one side of the middle of the face'. They were unable to recall which side of the face. They recalled that the girl in question had some 'silver' fillings, but they did not know how many. Following this evidence, six photographs were acquired of the girl at various times before death. One of

(a)



(b)

FIG. 3 (a) Labial inclination of the prosthetic replacement of the upper right lateral incisor. (b) Labial inclination and mesio-labial rotation of the upper right lateral incisor.

these showed a distinctive malocclusion of the Class II division 2 type with a clearly visible labially inclined and rotated upper right lateral incisor (Fig. 4).

Photographic Superimposition

This was carried out using electronic cameras imaging the photograph (Fig. 4) and the skull. The method allows the skull to be optically 'distorted' to match the optical distortion in the photograph and is our modification of methods previously described (Pesce Delfino *et al.*, 1986; Sueshige and Yoshimo, 1993). In our method allowance was made for soft tissue thickness typical for Caucasoid female children (Dumont, 1985; Hodson *et al.*, 1985). The superimposition was carried out 'blind' by using photographs of children of similar age who were not involved in the case and all data were recorded in real time on VHS or Eumatic video recording equipment. When a satisfactory 'match' was achieved, images of the skull and facial photograph were captured on traditional photographic cameras aligned along the optical axes of the electronic cameras. These high resolution images were used to prepare transparent overlays of skull and facial photographs for demonstration, via an overhead projector in Court (Fig. 5). It was concluded that the 'fit' of the teeth, including the labially inclined upper right lateral incisor, the orbits, and the bony and soft tissue features of the face allowed an opinion to be given to the Coroner that the remains were likely to be those of the named young girl. Although the evidence from reconstruction and superimposition was crucial in determination of identity, an age at death determination from radiographs (Moorrees *et al.*, 1963; Demerjian *et al*., 1973), and other circumstantial evidence was also presented in Court.

FIG. 4 Enlarged facial detail of a possible victim.

FIG. 5 Electronic superimposition of facial and skull images indicate exact fit of anterior dentition, and bony contours of mandible and maxilla. This 'still' from a video is without artificial 2|.

Discussion

Although there has been a small number of references to the input of orthodontic skills to the solution of forensic problems (Harris *et al.*, 1970; Gysel, 1971; Salzmann, 1974; Hagg and Taranger, 1982), only general principles have been discussed and there appear to be no specific case histories in the literature. This present identification, forming part of a very high profile serial murder case, is the first case reported in detail, where advice and practical technical help was sought from colleagues involved in orthodontic practice. It is important that clinicians involved in reconstructions of this nature are given no information regarding the case itself or known characteristics of a possible identee in order to minimise bias. The facial superimposition technique using video recording has been assessed previously (Iten, 1987) and standards of procedure have been established Dongsheng and Yuwen, 1993). If possible, photographs in both the full-face and lateral views should be assessed to support a positive identification (Dorion, 1983). These were not available in this case, but two independent photographs of the same girl produced a good 'match'.

Identification acceptable to the Court was dependent upon numerous factors, such as age determination, facial shape, and overall 'fit' of photographs and skull, but there is no doubt that in this case the labial angulation of the reconstructed upper lateral incisor, its accurate fit to the photographs and its recall by relatives also were important features of the identification procedure. The case illustrates the importance of involving experts in a variety of clinical disciplines in forensic case work.

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