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General Articles

The Law and the Dentist

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X.—Forensic Dentistry

Definition

DENTAL jurisprudence or forensic dentistry may be defined as the application of dental science to the administration of the law. In 1865 in his 'Principles and Practice of Medical Jurisprudence,' Taylor described forensic medicine as a term which implied 'the application of every branch of medical knowledge to the purpose of the law and hence its limits are on the one hand the requirements of the law and on the other the whole range of medicine.' Forensic dentistry can surely be similarly described.

Development

References to the application of medical science to the solution of legal problems are to be found in the literature of such ancient civilisations as those of Egypt, Greece, India and China. There appears, however, to be no specific written mention of dental participation in such activities until the last decade of the nineteenth century, when in one or two cases it was reported that dental evidence was taken to establish the identity of dead bodies. Then in 1898 there appeared the first great written work on forensic dentistry namely the treatise entitled 'L'Art dentaire en Medicine legale,' by Amoëdo of Paris.

Since then papers and articles on various aspects of the subject have been published, some containing suggestions on the best ways it should be organised and developed and others pointing out various ways in which the law could make greater use of the knowledge of dental experts. There have also been accounts in the dental literature from time to time, of particular instances where dentists have been called to give expert evidence in criminal proceedings or to assist in problems of identification.

But, as yet, little has been done to organise any system of application of odontology to forensic problems, nor has the subject of dental jurisprudence been included in the teaching syllabus of most of our schools, or been furthered by the efforts of research workers. In fact, to date, cases in which dentists have been required to lend their aid have been sporadic in both occurrence and distribution, although in these, *ad hoc* measures taken by the dentists involved have achieved considerable success. But as Gustafson (1958) pointed out 'those of us who deal with these problems are all amateurs who dabble a

little as the occasion arises.' Surely then there is a need for trained experts, because improvisation such as the above can never be as efficient or of such wide application as the work of one who has specialised in this particular field.

Scope

Means of Identification

Up till now, dental evidence has been principally applied to the identification of both living persons and human remains and it is probable that it will always be on the solution of this most important and often difficult problem that the forensic dental expert can be of most assistance.

Identification from dental data may be the only form available when bodies have been destroyed beyond recognition by fire, or severely mutilated in road, rail or air crashes. It is also extremely valuable when the body requiring identification has been immersed for any length of time after drowning, or has been buried and later exhumed, and indeed in any case when a body is not available until some time after death when the more usual identifying features have been destroyed by decomposition.

In the field of criminology evidence of identification is often difficult to obtain: when, for example, a murderer has taken measures to remove it by grossly mutilating or even attempting completely to destroy his victim's body.

Identification of living persons is often unreliable when based on opinions as to likeness of features, similarity of handwriting and such factors, and scars, moles and other skin markings are possible of removal in most cases.

Determination of Age and Occupation

There are a few reported cases in which dental evidence showed the probable occupation of the persons whose remains were the subject of examination, and others in which the age of death was deduced from the dental conditions.

One famous murder trial is of particular interest in this respect, because in it one factor of considerable importance in bringing the murderer to justice was the establishment of the ages of the victims at the time of their deaths and this was done largely by dental evidence. The case was that of *R. v. Ruxton*, 1935, in which, following the reported disappearance of Mrs. Ruxton and her maid, the mutilated fragmentary remains of two females were discovered in widely separated localities. When these fragments were assembled it became obvious that very thorough measures had been taken to prevent identification, for in addition to the hands, eyes, ears and scalp, even a few teeth had been removed after death. However, it was found possible on the remaining dental evidence to assess

the respective ages of the two women. In the case of one, the four third molar teeth were unerupted and none of their roots were fully calcified suggesting an age of between 18 and 20 years. In the other all the wisdom teeth had erupted, two had been removed, and of the other remaining two, $\bar{8}$ was grossly carious and only a root of $\bar{8}$ remained, giving at least the presumption of an age of more than 25 years. Mrs. Ruxton and her maid were known to be aged 35 and 20 years respectively at the time of their disappearance so that further investigations were instituted on the assumption that the remains might be those of these two missing women. Comparison of the dental condition of the remains with the records of practitioners who had treated Mrs. Ruxton and her maid revealed a measure of agreement which was large enough, when added to certain other facts pointing to the same conclusion to provide satisfactory proof of identity.

Age determination of human remains by dental means has been the subject of considerable study and several ingenious methods have been suggested whereby the deductions made as a result of an orthodox dental examination might be reinforced.

During the period of tooth development, age can be estimated with reasonable accuracy by comparing dental radiographs with a diagrammatic table of tooth chronology such as that prepared by Schour and Massler (1940). The accuracy of this method, however, diminishes from the age of 12 onwards and become valueless after age 20, when the factors of calcification and eruption no longer apply.

In searching for other criteria by which ages over 20 years may be estimated, attention should probably be focused on the method devised by Gustafson (1950) as the most effective. This consists of a system of awarding points for departure from the normal on each of six observations, namely:

- (1) The amount of attrition due to masticatory function.
- (2) The amount of secondary dentine deposition.
- (3) The amount of gum recession and alveolar resorption.
- (4) The amount of new cementum deposited.
- (5) The degree of translucency of the root, denoting progressive hypercalcification with age.
- (6) The amount of root resorption.

This method has the advantage that it can be used when few or only a single tooth are available, but it is on the other hand time-consuming, and requires a specialised technique of tooth sectioning and microscopy as well as an observer trained and experienced in making the required estimations of abnormality.

Another interesting suggestion with the same

object in view is that of Scott *et al.* (1949) and Pedersen and Scott (1951). These workers suggest that there is a progressive decrease of visible structure on the surfaces of teeth with increasing age, a phenomenon which could be used with advantage as a method of age determination.

A third possible method is based on the suggestion first made by May (1952) that there is a relation between the age of a person and the weight of the mineral content of his teeth revealed by weighing their ash content. This theory has been extensively tested by Stack (1960) who applied it to estimations of age during fetal life and infancy.

Nature of Dental Evidence

The evidence available to a dental forensic expert possesses one advantage over most other types, namely that of its relative indestructibility. Not only are the teeth themselves and the bone in which they are held, but also the materials with which they are restored and replaced, most likely to remain preserved long after other body tissues have been destroyed either by natural processes or by the efforts of criminals to cover their tracks.

A dental examination will reveal a set of facts which must be unique to that particular dentition, a fact which is obvious when thought has been given to the number of possible combinations in which thirty-two teeth may be present, absent, replaced or conserved. To this number already astronomical must be added further individual variations in respect of abnormalities in form and arrangement of the teeth, retained roots, particular materials used for fillings and prosthetic appliances and the particular form or design of these replacements.

Evidence is therefore available as a mass of relatively indestructible detail in the sheltered oral cavity, by which it may be possible to show the identity, age, habits, occupation (and possibly the presence of disease) in either a living person or a dead body. But any dentist engaged in this problem suffers one big disadvantage in that in most cases he is dependent on the fullness, accuracy and availability of the dental records of others. These of course he must have, particularly in problems of identification, to compare with his own findings, and although National Health record forms have improved the situation in recent years, this is still the main factor limiting the application of forensic dentistry.

Application

There have been a number of famous cases in which dental evidence has been the main, sometimes even the sole means, of establishing identity, and on many other occasions dentists have assisted in this most important procedure, thereby helping to bring criminals to justice; or in civil cases preventing

successful imposture or fraud, or enabling proof of leath to be established under various circumstances.

Evidence of Dentures

In *R. v. Haigh*, 1949, the victim's body was completely destroyed by sulphuric acid. The police were able to recover from the resultant sludge only one or two recognisable human remains, but they did find in it complete upper and lower dentures, which had been only slightly affected by the acid. These dentures were conclusively proved to belong to a Mrs. Durand Deacon by the dentist who supplied them. This dentist had still in her possession the models of a patient of that name and she was able to demonstrate that the dentures accurately fitted these models. It was largely due to this piece of evidence that the murderer Haigh was indicted and later convicted.

Evidence of Tooth Roots

Dental evidence, particularly that in respect of certain retained buried tooth roots, played a big part in the conviction of the murderer in the celebrated Baptist Church Cellar Case, *R. v. Dobkin*, 1942 (Fry, 1943). Rachel, the wife of one Harry Dobkin, had disappeared and the police were aware that Dobkin who was a fire watcher had behaved suspiciously when fire broke out in the cellar of the Kennington Baptist Church. But it was not until a year later that a partially burnt and dismembered body was dug up at the site of this fire.

In the vital matter of identification it was possible by the usual means to say only that the remains were those of a female who had been strangled more than twelve months previously. However, the dentist who had treated Mrs. Dobkin was found, and from his very full and accurate records was able to show that she had a peculiar shape of upper jaw and a charting of teeth standing and fillings inserted identical with those of the corpse. He was further able to describe two premolar roots which he had left *in situ* when he extracted the teeth and radiographs of the jaw of the dead woman, produced at the trial by Sir William Kelsey Fry, showed these roots still present. This dental evidence conclusively identified the victim.

Study the Bite Marks

From time to time criminals have been identified by the marks made by their teeth after they have bitten into either articles of food or into human tissues.

A case recounted by Detective Sergeant Cowley (1954) concerned a thief who ate an apple and left the core on the scene of his crime. The tooth marks in the apple core showed that it had been eaten by someone who had a marked diastema between the central incisors, making positive identification of one of the suspects of the

burglary easy and sure, and incidentally completely clearing a man who had been under suspicion previously.

Perhaps the best impression materials among the common foodstuffs are cheese and butter, and models cast from tooth marks in these commodities can provide considerable detail and accuracy especially if casting is possible shortly after the material has been bitten.

In two savage murders, in both of which young women had been subjected to violent sexual assaults, the identities of the criminals were established in part, by comparing the tooth marks they left on the bodies of their victims with models made from impressions of their teeth.

In one of the cases, *R. v. Gorringe*, quoted by Dr. Keith Simpson (1951), the dead woman had been assaulted both physically and sexually and bite marks were present on her right breast. Models made from impressions of her husband's teeth which were described as 'badly spaced, angled and curiously shaped' were found to fit the bite marks in the tissues, and this evidence helped substantially in securing a conviction.

In the case of 'the Bournemouth murderer' *R. v. Heath*, both nipples of Heath's first victim had been bitten off and there were distinctive tooth marks in the upper part of the breasts.

Generally speaking, however, identification from evidence of bite marks is not often possible and technical difficulties are likely to prevent the estab-

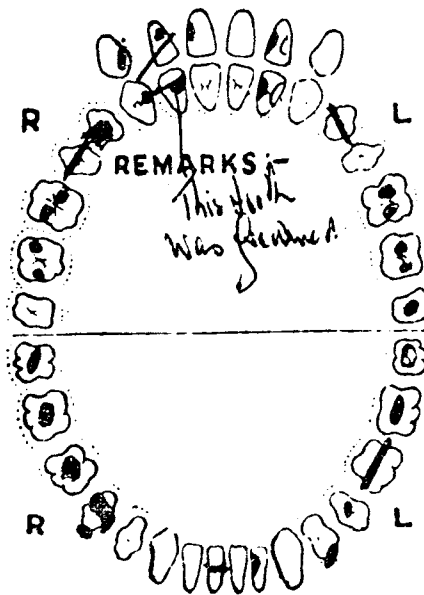


FIG. 1.—Chart prepared by Lieut.-Colonel Howse, R.A.D.C., from the body, January 4, 1957.

lishment of convincing proof in most cases. Investigations of this nature are only likely to produce consistently good results when carried out by a trained forensic expert.

Comparison with Existing Dental Records

It has been mentioned previously, that the success or failure of a dental forensic investigation very often depends on the availability of complete up-to-date dental records which may be compared with the dental conditions found on examination of the person or body to be identified.

A good illustration of the value of precise recorded dental data is to be found in the successful identification of the body of Lieut. Moorhouse. This officer was captured during the Suez campaign in 1957 by the Egyptians, who after cessation of hostilities returned an unrecognisable corpse to the British authorities stating that it was his body. A team of forensic experts was sent out from this country to identify this body and included in it for the purpose of supervising the dental element of the investigation was the late Lieut.-Colonel K. Howse, R.A.D.C.

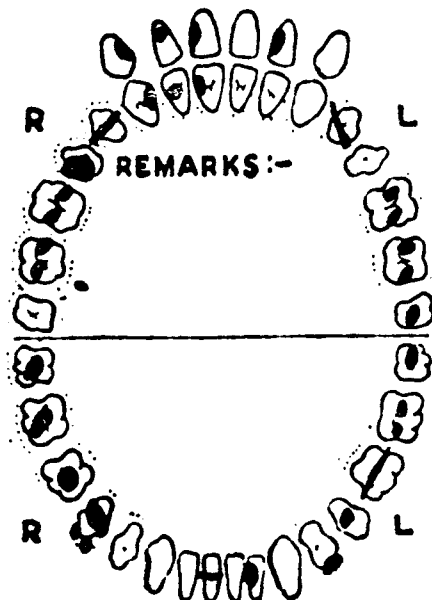


FIG. 2.—Chart compiled from information obtained from previous dental treatment cards.

Figure 1 shows the charting of the dental conditions found on examination of the body. Figure 2 is a chart compiled by Howse from the field records of the dental condition of Lieut. Moorhouse when he first joined the Army and of the dental treatment he had received subsequently. Figure 3 shows the most recent dental treatment card showing that a root

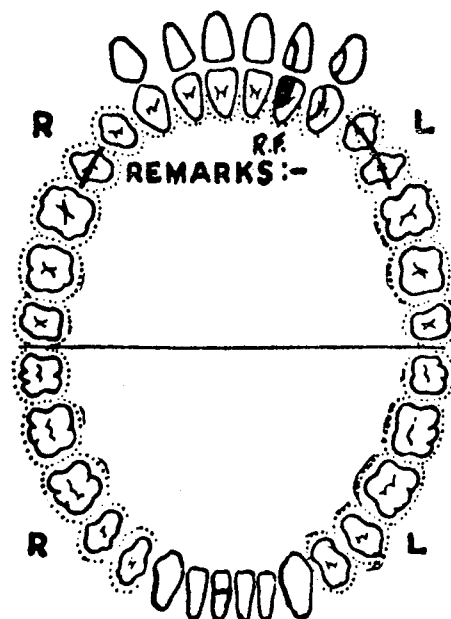


FIG. 3.—Chart giving details of treatment. 1.1.56 referred for x-ray; 9.1.56, appointment for apicectomy; 2.24.2.56, apicectomy and root filling; 2.2.56 completed.

filling and an apicectomy had been carried out a recently as February 24, 1956, on 2 and fig. 3 shows the post-mortem radiograph demonstrating such a condition in that tooth.

The similarity of the dental condition of the corpse to that shown in the record of Lieut. Moorhouse was such that on dental grounds alone the identity of the body produced by the Egyptian authorities was proved.

Concluding Comment

From the foregoing the following points would seem to emerge:

- (1) That until recently the value of forensic dentistry has been but little recognised, and on only few occasions have the services of dentists been utilised in this field.
- (2) But that, as shown in the literature, even with such meagre experience dentists have been able from time to time to be of great assistance in the solution of legal problems.
- (3) However, to obtain the greatest advantage from the application of dental knowledge it is surely necessary to train a limited number of dentists in both the practical and scientific aspects of forensic dentistry, so that, when required, a dental expert can take his place as a specialist in what is, in fact, a branch of forensic medicine, in any investigating team.



FIG. 4.—Post-mortem radiograph showing condition of 2.

With this object in view it would seem desirable that elementary teaching of the subject, should be included in the undergraduate curriculum.

- (4) That much dental and allied research in the forensic field needs to be undertaken in order to put the subject on a more scientific and organised basis.
- (5) That the adequate records now required to be kept as a condition of the N.H.S. have proved of inestimable value in identification problems. As a measure of wider scope it has been suggested that some form of international standardisation of dental records should be attempted, using possibly a suitable punch cards system. Maybe this is beyond fulfilment, but the idea of establishing an international register of the dental data of missing persons seems feasible and would certainly be a great help in questions of identity. One other suggestion is perhaps worthy of consideration. This is that dentists should be asked to mark the dentures they supply according to some overall system. Again this project would not seem to present any insuperable difficulty and has in fact already been put into effect in some of the armed forces dental services with proved benefit.

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(To be continued)

Radiology in General Dental Practice

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IV.—Appearances Simulating Inflammatory Apical Lesions

AMONG the first things that a dental student learns about dental radiology is that a zone of bone destruction around the apex of a tooth is inflammatory in origin and implies a pulpless tooth. He then finds that not all localised areas of radiolucency about a tooth apex are pathological, some being due to superimposed anatomical features. Later on he realises that certain non-inflammatory pathological processes can likewise cause destruction of periapical bone.

Although knowledge of these conditions is imparted to all undergraduates, each fresh patient who presents with an apparent periapical lesion poses a new problem in differential diagnosis and it is useful from time to time, to review the possible causes. In all cases a vitality test should be performed as part of the investigations. Only in this way will vital teeth be spotted and errors of diagnosis involving some of the rarer, but important conditions, avoided.

Anatomical Features Simulating Destruction of Apical Bone

(a) The Incisive Fossa and Incisive Canal Cysts

In periapical views specifically taken for one or the other upper central incisor, that is with the tube oblique to the sagittal plane, the incisive fossa may be superimposed over the apex of the tooth. While in some patients the incisive fossa is a shallow palatal depression, in others it is a deep concavity. Variations in width also occur. It is the deep type which occasion most confusion. They produce a considerable, localised reduction in the thickness of the jaw with the lateral margins of the fossa lying parallel to the x-ray beam: both factors leading to a dark, well defined shadow.

In an oblique view of the upper incisor region, only the incisive canal of the same side is projected sharply on to the film. The image which it casts, together with that of the incisive fossa with which the canal is continuous, resembles a flask in shape (fig. 32). As the lower boundary of the incisive fossa is often not sharply recorded on the film, the appearance is of a flask, orientated the right way up, but with an indistinct outline at the bottom. If the image of the incisive fossa is superimposed on that of a healthy central incisor the periodontal mem-