

## THE DENTITION IN STUDIES OF SKELETAL MATERIAL FROM ARCHAEOLOGICAL SITES

Dorothy A. Lunt, University of Glasgow Dental School

Study of skeletal material from excavation sites often produces information concerning the number of individuals buried, their sex and an approximation of their age at death, while occasionally the cause of death or the existence of certain diseases can be established. Under unfavourable soil conditions, however, bones disintegrate completely. The crowns of the teeth are more resistant to post mortem attack, and may survive in a state of reasonable preservation when the bones have disappeared. In such cases, the teeth are of paramount importance as a source of information about the individuals from the burial site. Even when part or all of the skeleton survives, the teeth may still provide valuable data in addition to that which can be deduced from the bones. Depending on the extent to which the skeleton has survived, therefore, the teeth may supply corroborative, additional or exclusive information under a number of headings.

Number of individuals. Many human teeth can be identified with complete accuracy, and the others can be recognised with reasonable certainty in a high proportion of cases. If several individuals have been buried together, and the burials have become severely disturbed, it is possible to classify collections of loose teeth by types and to establish at least the minimum number of persons buried. Since teeth from the same individual usually show similarities in colour, shape and degree of wear, such collections of teeth can usually be assigned to separate sets, and a fairly close estimate made of the number of skeletons originally present (e.g. Appendix A in Corcoran, 1966).

Age of individuals. The assessment of age falls into two categories: (a) for those aged less than 18 - 20 and (b) for those aged over 20. In category (a), assessment of age is based upon the state of development of the dentition. Detailed studies of the chronology of development of deciduous and permanent teeth have been carried out on modern European children, and various stages of development of the teeth can be timed to within two years, allowing for normal variation (Johanson, 1971). Using this information it is possible to assess the age of a skeleton to within two years up to the age of fifteen, and with a little less certainty from fifteen to twenty, since the third molar is more variable in its chronology than the other permanent teeth.

It may be argued that data derived from modern European populations do not necessarily apply to individuals from prehistoric periods. In some modern non-Caucasoid populations, the teeth erupt rather earlier than in Caucasoid groups, and it could be suggested that prehistoric European races may have been similar in chronology of tooth development to modern races living under primitive conditions rather than to modern Europeans.

However, when the data are examined carefully it is seen that, with the exception of third molars, permanent teeth do not usually erupt more than one year earlier in non-Caucasoids than in Caucasoids (Krumholt, Roed-Petersen and Pindborg, 1971; Debrot, 1972). The third molars may erupt as much as four years earlier in non-Caucasoid populations, and the difference has been shown to be due to a relative delay in the start of development of these teeth in Caucasoid groups (Fanning and Moorrees, 1969). As far as can be judged from the small amount of material available, the relative chronology of second and third molar development in Scottish prehistoric populations appears to be similar to that of modern Caucasoid groups, and it therefore seems reasonable to apply the data concerning tooth development derived from these groups in the assessment of age of prehistoric children and adolescents.

For category (b), the assessment of age is based upon the amount of wear exhibited by the permanent dentition, and in particular by the molars. The occlusal surfaces of the permanent molars in any quadrant of the mouth will always show different degrees of attrition, since first, second and third molars do not erupt together, but at roughly six-year intervals. Miles (1963), in a study of a fairly large series of Anglo-Saxon skulls from Breedon-on-the Hill, ranging in age from those of children to those of elderly individuals, made use of the differential wear of the mandibular molars to construct an attrition scale from which age could be assessed up to about 68. The accuracy of such an estimation becomes less as the age increases, but up to the age of 48 the degree of attrition of all three molars can be assessed simultaneously, and for individuals between 20 and 40 the assessment of age would appear to be reasonably accurate within four years.

The results obtained by Miles can strictly be applied only to the particular Anglo-Saxon population which he studied. Unfortunately, so far as the prehistoric periods in Scotland are concerned, there has been no single population group available with a similarly restricted geographical range and with an equally large range of ages represented. A comparable study of attrition in Scottish skulls has not been possible. However, if one assumes that the populations of prehistoric and early mediaeval Scotland consumed diets of

a coarseness comparable to that of the Anglo-Saxons of Breedon, then Miles' scale of attrition may be cautiously applied in the assessment of age in Scottish skulls. In many cases, I have found that the relative amounts of wear of the molars have matched those on Miles' scale exactly, and in these cases an assessment of age may be made from the scale with some degree of confidence. Where discrepancies in the relative amounts of wear exist, considerable caution must be exercised. Nevertheless it is usually possible to give an estimate of age to within five years. It must be pointed out that modern Europeans subsist on much softer diets than their ancestors, and that wear of the teeth in modern times proceeds so slowly as to be of relatively little use by itself in the assessment of age, e.g. for forensic purposes (Johanson, 1971).

Sex of individuals. Although it can be shown from population studies that the teeth of males are significantly larger than the teeth of females (Lunt, 1969), the difference is too small and the range of variation too great for the sex of an individual to be assessed from tooth size.

Dental health. The incidence of dental caries, periodontal disease, pulp exposure due to excessive wear and dental abscess formation serves to indicate the general state of oral health of the individual. Sometimes it is possible to deduce that a person had been suffering from severe toothache, or abscesses with sinus formation ('gum-boil'), or even chronic maxillary sinusitis.

Preservation of the dentition. In the study of those aspects of the dentition which produce data of interest to the archaeologist, the crowns of the teeth are usually of greatest importance. The crown of a tooth is covered by enamel which is extremely hard, and also very brittle under certain circumstances. During life, the enamel is supported by the elastic tissue dentine which forms the bulk of the tooth, and while the skeleton remains in the ground the teeth are kept moist and the dentine maintains its normal volume and shape. When the skeleton is excavated and brought into a warm dry atmosphere this moisture is lost, and the dentine often, though not always, shrinks a little. Enamel does not contract when it dries, and is thus left as a relatively unsupported brittle shell over the crown of the tooth. Under these conditions, cracking and chipping of the enamel occurs and the crown of the tooth may eventually be completely denuded of enamel.

An even worse situation arises if the soil has been of the type which leads to bone degradation and disintegration. Dentine is also involved in this kind of destruction although enamel is not outwardly affected by it. The final result

will be almost total loss of dentine and the survival of an exceptionally brittle shell of enamel which may crumble into fragments when it dries out. In either case, the loss of enamel results in destruction of the features most useful to the dental anthropologist. This deterioration of the dentition can be prevented if the teeth are kept moist (in polythene bags) after excavation until they can be examined by the dental expert. If the skeleton is in a severe state of disintegration no attempt should be made to free the teeth from the mass of soil. The final removal of the teeth and adherent fragments of bone from the soil should be done by the dental expert. The teeth are then carefully washed, and a protective varnish applied to form a thin hard film over the enamel and prevent its breaking into fragments. The only satisfactory material for this purpose that I have so far discovered is a 10 per cent solution of polyvinyl acetate (M.W. about 33,000) in absolute acetone. Speed is essential in this process: a delay of 15 minutes between final cleaning and the application of the varnish resulted on one occasion in the collapse of a perfectly whole premolar crown into a heap of unrecognisable and irrecoverable fragments. But if the dentition is kept moist, and then properly cleaned and conserved, even the most unpromising burial in a state of almost final disintegration may be made to yield evidence of interest and value to the archaeologist.

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