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External And Intrinsic Signatures In Human Teeth to Assist Forensic Identification Work

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ABSTRACT

In forensic medicine, dead victim identification constitutes an important task for forensic professionals including forensic pathologists, anthropologists, and odontologists.
If no clues are at hand regarding the identity of the deceased, whether it is a victim of a mass disaster or a suspect homicide case, it is vital to know when a person died, and to know the sex and age of the decedent in order to limit the search for possible matching persons.
In paper I, teeth from Swedish individuals were examined using both ^{14}C analysis and aspartic acid racemization. The ^{14}C analysis takes advantage of the so-called bomb-pulse, a tremendous increase of ^{14}C in the atmosphere due to thousands of test detonations of nuclear weapons 1955-1963, which allows for an accurate birth dating of modern biological material. The aspartic acid racemization method gives an estimate of the age at death. The methods showed a significant correlation, and by combining them, we showed how both the year of birth and year of death of an unknown skeleton could be determined. In this study, we also found that ^{14}C levels in tooth enamel from Swedish teeth predicted the true date of birth with an average absolute error of 1.3 ± 0.9 years and that analysis of whole crown offered fairly good precision too.
In paper II, the possibility of geographical differences in precision due to uneven distribution of bomb-pulse radiocarbon during the test bomb period was addressed. Interestingly, the ^{14}C determinations predicted the true date of birth with a similar precision even when analyzing teeth from different continents. Conversely, the levels of the stable isotope ^{13}C showed significant difference depending on geographical origin.
In paper III, teeth were collected from North America to find out if differences in stable isotope concentrations can be detected in the teeth from subjects raised in such a limited geographical region. Teeth collected from subjects raised in Mexico showed extremely high ^{13}C values, most likely due to a high consumption of corn and sugar cane. ^{13}C levels in tooth roots were also higher in Mexican subjects compared with persons raised in United States and Canada, but the difference was not as conspicuous. Incorporation of ^{18}O, another stable isotope, is mainly dependent on the drinking water. Analysis of ^{18}O in tooth roots from subjects raised in Northwestern America showed the lowest levels, whereas this marker was not reliable for discriminating between Mexican and southern United States subjects. The ^{14}C determinations of date of birth on North American teeth showed only slightly higher imprecision (average absolute error 1.8 ± 1.3 years) than Scandinavian teeth. In paper III, these and previous tooth ^{14}C. Finally, a reference guide to birthdating persons using tooth ^{14}C values is provided in paper III.
In summary, these studies describe methods to determine date of birth, date of death, and origin of unknown dead victims, information that is expected to facilitate the identification work.

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