Some Dental Traits in Different Evolutionary Lines Leading to Modern Man

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Dental morphological traits have been long used successfully for the taxonomy of both modern and fossil humans. Dental morphology provides the possibility for direct comparisons of modern populations with fossil hominids in order to study the origin of contemporary humans. In particular, an attempt may be made to address questions concerning the time and place of divergence of evolutionary branches leading to the existing taxonomic subdivisions of *Homo sapiens sapiens* subspecies. Special attention must also be paid to the genetic role of the eastern and western branches of *Homo erectus* in the formation of modern mankind, as well as to the problem of hybridization between populations belonging to different evolutionary stages within the evolving genus *Homo*.

Unfortunately, not all dental features can be used for these purposes due to the small number of fossil specimens and the high degree of attrition on the masticatory surface of fossil teeth. However, the analysis of even one or two features can be of interest in such a situation. Therefore, we have chosen two traits for the present study: the structure of the lingual surface of the upper incisors and one of the trigonid crests on the lower molars, the so-called "epicristid" (or middle trigonid crest).

The lingual surface of the upper incisors usually draws the attention of dental morphologists, due to the "shoveling" or strong expression of marginal ridges. However, in this paper shovel-shape, itself, is not the subject of research. Focus is instead placed on the structure of the lingual surface as a whole, including the basal lingual tubercle. The Japanese dental morphologist Mizoguchi (1985) defined three incisor variants according to the degree of expression of marginal ridges and their connection with the lingual tubercle. These are: 1) weak marginal ridges converging towards the cervix, 2) strong parallel non-converging ridges and a large lingual tubercle, and 3) markedly developed and converging ridges and a reduced lingual tubercle.

The middle trigonid crest belongs to the system of trigonid crests of the lower molars. The Dutch dental anthropologist, Korenhof (1982) described three trigonid crests. The distal crest is a good marker of the modern Mongoloid race. The middle trigonid crest has attracted less attention, but is no less important. The middle trigonid crest is formed by the main ridges of the protoconid and metaconid in the middle of the trigonid area. According to the terminology suggested by the American paleontologist, Hershkovits (1971), this feature must be called an "epicristid".

One of the most important assumptions behind all future statements is that a strong genetic component determines incisor type and epicristid. Numerous authors have shown the genetic component of dental features, especially through the use of twin analysis. However, investigations have also shown the considerable importance of environmental factors and adaptation on the formation of tooth structure. For instance, Mizoguchi found a significant correlation between the degree of expression of shoveling and climatic factors, type of economy, and food composition. Accordingly, inter-population difference was caused by local adaptation to specific environmental conditions.

I cannot fully agree with Mizoguchi's point of view. In my opinion, the geographic distribution of dental characters depends, at least in part, on the ancient pattern of genetic polymorphism connected with the taxonomic differentiation of the genus *Homo* at certain stages of its evolution. Otherwise, it would be difficult to explain 1) the subdivision of some of modern mankind's morphological dental traits into eastern and western divisions, 2) instances in which identical dental types (genetically related) are encountered in different economic and climatic conditions, and 3) cases in which different types occur in similar conditions.

Furthermore, it would be difficult to explain the possibility of revealing traces of ancient admixture of geographically remote populations by using dental morphological data to analyze the consequences of migrations and inter-population contacts. It would also be difficult to explain how evidence of ancient admixture of geographically remote populations can be identified through analysis of dental morphological data to illustrate consequences of migration and inter-population contacts. I could bring in more arguments, but then I would deviate too much from my theme of analysis of genetic aspects of the dental variation in the genus *Homo* connected with its evolutionary history.

Herein we consider the question of the extent to which incisor type and epicristid reflect the genetic relationship and evolutionary progression between fossil hominids and modern man and how far back in time we can trace this progression.

Upper incisor type 1 presently prevails in the dentitions of peoples living in Africa, Europe, and neighboring regions of Asia. This type has persisted in Africa from the beginning of human evolutionary history. Type 1 was seen in *Australopithicinae*, *Homo habilis*, fossil man from Rabat (early *Homo sapiens neandertalensis* or late *Homo erectus*). It can be regarded as the predominant form in Africa during the past ten thousand years. Type 1 is also widespread in the dentitions of peoples living in Europe, and indicates close genetic relations between the modern European population and fossil hominids of Africa. This new evidence supports the "Afro-European" theory developed by Bräuer (1984) and Stringer (1985).

During the period of the Neanderthal stage of evolution, the Africa-Europe transition in dental morphology was apparently interrupted, since Neanderthal man in Europe had upper incisors with a marked degree of shoveling and clearly expressed type 2 incisors, quite similar to *Sinanthropus*. This seems to attest to the possible migration of populations from Asia into Europe during that evolutionary stage. The result was that European Neanderthals had to be, to some degree, of Asiatic origin in their genotype.

Type 1 incisors constantly moved into both Europe and Asia with migrants from Africa who ousted populations having type 2. Along the way some intermediate incisor variants were produced through hybridization (for example, the Amud Neanderthal and the first *Homo sapiens sapiens* from Qafzeh). "Hybrid" forms of incisors continued in Europe for a long time. Incisor shoveling existed in the Upper Paleolithic (e.g. fossil remains from

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Romito cave, Italy (Fabbri and Mallegni, 1988) and even in early historic time (73% in Crete [Mizoguchi, 1985]). However, the "hybrid form" is neither a primitive type 2 nor a "pure" type 1, but intermediate between types 1 and 3.

The spectrum of intermediate forms, which had been created through hybridization of types 1 and 2, spread through Asia and became the common morphologic structure of incisors for modern Mongoloid populations. Sometimes the range of variation was closer to type 1, and other times closer to type 3. The latter is due to the inflow of genes from the local aboriginal ancient hominids. This form is characteristic of Arctic races and American Indians.

The other Asiatic forms, in my opinion, should be regarded as hybrid forms. Here, I cannot agree with Mizoguchi who considers these forms as type 1 only. The authentic "pure" form 1 remains in Africa and Europe after the partial elimination of hereditary traits of the Neanderthal population. Mongoloids preserve the hybrid genotype, including both eastern and western components. Here two contradictory views can be reconciled. One has been proposed by Andrews (1984) who advocates the idea of a western origin of modern humans; the other, by van Vark (1983), who suggests the opposite solution of the problem by reducing the genotype of modern humans to only the Asiatic evolutionary branch. In this view both European and Asiatic representatives of contemporary humans have hereditary traits of *Homo erectus africanus* and *Homo erectus asiaticus*. In Europe the eastern traits obtained from Neanderthal man 30,000 to 35,000 years ago were greatly depleted by later waves of African newcomers. However, in Asia the eastern traits were intensified by local eastern admixture.

We now turn to another dental trait, the epicristid. This feature was common among fossil hominids in Africa (*Australopithicinae*, *Homo erectus*, in particular *Atlanthropus* [editor's note: a generic name for middle Pleistocene African hominids]), in preneanderthal forms (Arago, Mauer), and in many European Neanderthal forms (Erinsdorf, Krapina, Hortu, Le Mousteier, La Fate). Epicristid does not seem to characterize fossil hominids in Asia. (No instances occur in the permanent molars of *Sinanthropus*.)

The combination of epicristid and incisor shoveling (Erinsdorf) can be regarded as evidence for the hybridization of the eastern and western evolutionary branches in Europe. The epicristid persisted in Europe into the Upper Paleolithic (for instance, the Saint-Rabier finding in France [Patte, 1962, 1963]). My unpublished data for modern populations is also of interest here.

The highest frequency of epicristid in modern ethnic groups has been found in Africa (Mali, Ethiopia). This fact suggests the retention of local ancestral features since very remote times, in a manner similar to the model we have been discussing for the distribution of type 1 shoveling. The epicristid trait penetrated into Europe from Africa at different stages of evolution (preneanderthals, *Homo sapiens sapiens*) and remains in Caucasoid (Euripeoid) populations, especially southern groups. The frequency of epicristid in Europe and India reaches 10% (Brahmans of India, Tajiks). The trait is completely absent in Mongoloid populations of Central Asia (Mongols, Touvinians [editor's note: native people of the Tuva Autonomous Republic in southern Siberia]) and American Indians (Peru) which I have studied. This trait may have disappeared in the course of time during migrations and hybridization processes. In western humans, one can observe a similar process, the elimination of shovel-shaped incisors.

The analysis of the evolutionary and taxonomic significance of these two dental features, incisor form and epicristid, enables us to draw the following conclusions:

1. The stable persistence of incisor type 1 in Africa since very remote time and its subsequent spreading throughout the whole world as a basic morphological structure corroborates the so-called Afro-Europe theory concerning the African roots of *Homo sapiens sapiens* (Bräuer, 1984; Stringer, 1985), and, in part, the genetic monocentric hypothesis of A. Wilson and V. Sarich based on mitochondrial DNA data ("Mitochondrial Eve theory"). However, contrary to Wilson's theory, the distribution of dental features attests to the widespread process of hybridization between the representatives of different branches and stages of evolution within the genus *Homo*, especially in Europe and Asia. To a great extent, modern African populations seem to preserve the ancient aboriginal "African" type for such dental traits as incisor type 1 and epicristid.

2. The morphological sequence in the distribution of incisor shoveling in Asia and epicristid in Africa, which can be traced back to the local *Homo erectus*, shows that not only a single common root but also genes of the local ancient hominids participated in the formation of the final genotype of modern man. In this respect, our point of view is compatible with both monocentric and polycentric theories for the origin of modern human races.

3. There were two waves of migrations from Africa to Europe: one on the level of *Homo erectus* (or preneanderthal man) and another on the level of *Homo sapiens sapiens* (through western Asia). Representatives of the first wave encountered the immigrants from Asia. According to dental data, hybridization occurred, resulting in the morphological combination of shoveling and epicristid.

4. *Homo sapiens sapiens* from the very beginning (Qafzeh) were in contact with Neanderthal populations on the way to Europe via the Near East and with Neanderthals in different regions of Europe. Hybridization must have taken place between *Homo sapiens sapiens* and *Homo sapiens neandertalensis*.

5. *Homo sapiens sapiens* of the Upper Paleolithic dispersing throughout Asia experienced strong genetic influence of local hominids. As a result, a wide range of variation between incisor types 1 and 2 arose, with the southern forms closer to type 1 and northern forms closer to type 2. The frequency of epicristid sharply decreased.

6. We suggest the following solution to the problem of an African or Asiatic origin of *Homo sapiens sapiens*: the whole subspecies *Homo sapiens sapiens* has a common basic African root. However, the genotype of *Homo sapiens sapiens* includes admixture of local populations of African, European, and Asiatic hominids belonging to different evolutionary stages. Moreover, from the distribution of incisor type 1 and epicristid, both western and eastern evolutionary branches of *Homo erectus* participated in the formation of modern humans.

7. The processes of hybridization within the genus *Homo* on all levels and stages supports the hypothesis of a reticular pattern as the characteristic mode of human evolution since at least the time of *Homo erectus*. This also provides evidence for consolidation of all representatives of the genus *Homo* into a single species, *Homo sapiens*.

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