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The Identification of the Eighteenth Dynasty Royal Mummies; A Biological Perspective

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Introduction

The mummies of the kings and queens of the New Kingdom Period (XVII–XXII Dynasties) are presently located in room 52 of the Egyptian Museum, Cairo. They were found in two caches at the turn of the century: (i) the Deir el-Bahari cache in the tomb of Queen Inhapi No. 320, discovered between 1875 and 1881; and (ii) the Tomb of Amenhotep II KV35 in the Valley of the Kings, discovered by Loret in 1898. It appears that non-royal mummies and mummies with no identification were either placed in coffins in the corridor outside the royal mummy room or on the third floor balcony. The skeleton from Tomb KV 55 in the Valley of the Kings was also placed in room 52. Except for Tutankhamon, all the kings were identified and rewrapped by the Priests of the XXI Dynasty after the plundering of the original royal tombs in the Valley of the Kings over a long period.

Most of the mummies from Inhapi's Tomb were unwrapped by Maspero in Cairo in 1884. All the mummies from the two caches were thoroughly examined by the British anatomist G. Elliot Smith and published in the famous 1912 Catalogue of The Royal Mummies.[1] Three of the mummies for which details were published by Smith, including Queen Tiye, were discovered by the former Director General of Egyptian Museums, Ibrahim El Nawawy in a side chamber of the tomb of Amenhotep II in the Valley of the Kings. In all, Smith describes the anatomical condition of 48 mummies from the Royal Caches and two from the Tomb of Thutmose III.

Methods

In 1968, a University of Michigan research team initiated a series of projects at the Egyptian Museum that resulted in a complete cranial and postcranial skeletal X-ray survey. Posterior-anterior (PA) and lateral cephalograms were obtained on every mummy, wrapped or unwrapped, which permitted craniofacial comparisons by measurement of the entire royal mummy collection. Although a complete review of the royal mummies in the Egyptian museum cannot be made in detail here, our knowledge of this invaluable mummy collection was extended greatly by the X-ray investigation. Normal human variation, disease, mummification techniques, age at death, cause of death and funerary artifacts were all documented. Arthritis, poliomyelitis, smallpox, arteriosclerosis, traumas, healed fractures, malocclusion and pulp exposures illustrate the effects of life, ageing and contagious disease in this remarkable collection.[2]

It was, however, the cephalometric X-rays that brought about the serious question of the identities of some of the mummies, much in the same way that Smith questioned correct identifications based upon his observations of craniofacial similarities and dissimilarities.

The National Institutes of Health had for many years sponsored the study of the inheritance of craniofacial variation at the University of Michigan, Department of Orthodontics. These investigations indicated that the heritability of the craniofacial skeleton (not soft tissue features) was multifactorial and polygenetic in character and did not follow simple

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Mendelian Laws of dominant or recessive characters or traits.[3]

When the craniofacial skeleton of first degree relatives (father, mother, brother, sister) is recorded by a cephalogram, traced and measured, the resulting variables should approach a 0.5 correlation. These same variables when measured between non-related individuals should approach 0. This was shown to be true in the study of a large series of nuclear families included in clinical studies at the University of Michigan. It must be emphasized here that *soft tissue features such as shape and size of nose, lips and ears* may well be inherited as sex-linked, recessive, dominant characters or traits.

Where Smith made *expert scholarly* judgements of similarity-dissimilarity between members of the Egyptian Royal Family, our approach utilized *quantification* and *statistical* analysis of the shape and position of the components of the craniofacial skeleton. Specifically, the mandible, maxilla, dentition and cranial base were traced and measured for every mummy and then compared by computer-generated overlays (Figure 1), angular measurements and ratios (Table 1) and cluster analyses (Figure 2). The overlays are particularly useful in visualizing similarities and differences in the shapes and position of the bones of the craniofacial skeleton of the royal mummies. At the same time the set of variables representing the craniofacial skeleton can be interpreted better by utilizing the overlays.

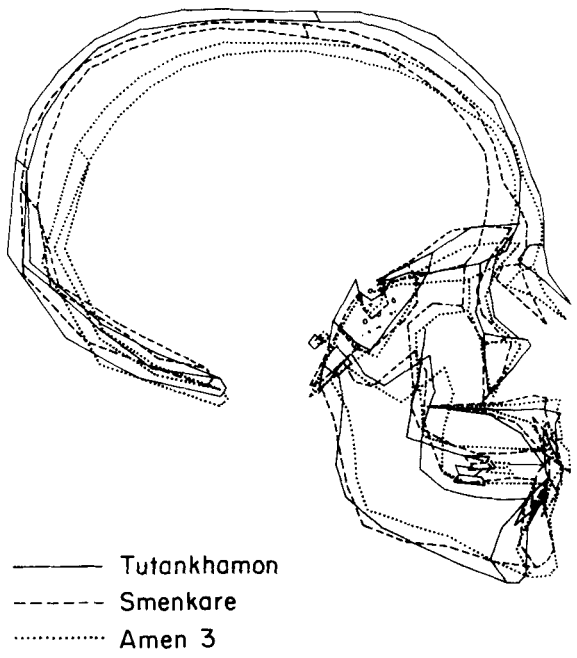

Figure 1. Computerized tracings of Tutankhamon, Smenkhkare and Amenhotep III (not corrected for size differences).

Statistical inspection of the data has the advantage that the investigator may communicate to the reader the numerical similarity or dissimilarity between subjects and the probability level of acceptance or rejection. In this study, utilizing the clinical research model, angular measurements were preferred to linear measurements in order to avoid variance ass-

Table 1. Cephalometric variables utilized to measure the craniofacial skeleton of the XVIII dynasty royal mummies: (1) interincisal angle (maxillary central incisor-mandibular incisor angle); (2) mandibular central incisor-mandibular plane angle; (3) A point-B point-occlusal plane angle; (4) gonial angle (articulare-gonion-menton); (5) upper face height-lower face height ratio (mm); (6) sella-nasion-mandibular plane angle; (7) sella-nasion-A point angle; (8) sella-nasion-B point angle; (9) cranial base flexure (nasion-sella-basion angle).

	Craniofacial measurements								
Pharaohs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Seti II	111.0	102.0	6.0	130.0	60/75	41.0	76.0	70.0	140.0
Thutmose II	115.5	93.0	3.5	135.0	55/70	40.0	80.0	76.0	134.0
Thutmose III	135.5	91.0	3.0	128.0	56/66	44.0	78.0	71.0	143.5
Thutmose I	95.5	117.0	4.0	126.0	55/62	37.0	89.0	79.0	130.0
Amenhotep II	134.0	92.0	0.0	122.0	63/78	32.0	90.0	86.0	130.0
Thutmose IV	140.0	87.0	6.0	120.0	53/61	30.0	86.0	82.0	128.0
Tutankhamon	130.0	98.0	6.0	122.0	67/67	46.0	80.0	72.0	133.0
Smenkhkare	133.0	96.0	3.0	120.0	60/72	44.0	80.0	72.0	—
Amenhotep III	137.0	91.0	-4.0	126.0	62/80	32.0	90.0	86.0	141.0

igned to size alone. Angular variables have been found to be particularly sensitive to the measurement of shape and the relative position of the mandible, maxilla, cranial base and cranium.

Cluster analysis is a multivariate approach that permits the examination of the royal mummies by utilizing a set of variables to determine the relative statistical distance between each individual. The weightings of the various variables are sometimes obvious, but often not. For example the similarity between Thutmose I and II can be assigned to those cephalometric variables representing bimaxillary protusion (a Nubian trait), i.e. SNA, ANB, SNB, interincisal angle.

Discussion

For a group of investigators concerned with human craniofacial variation and malocclusion, the differences in the faces and skulls in the New Kingdom Pharaohs and Queens were especially intriguing. This was hardly a homogeneous sample, and there were great differences both within and between the dynastic periods. The most heterogeneous grouping was that of the XVIII dynasty. What all of these mummies have in common is a long head or cranium (dolichocephalic) and a relatively delicate face, compared with the mummies of the XIX and XX dynasties and Old Kingdom mummies that our group has

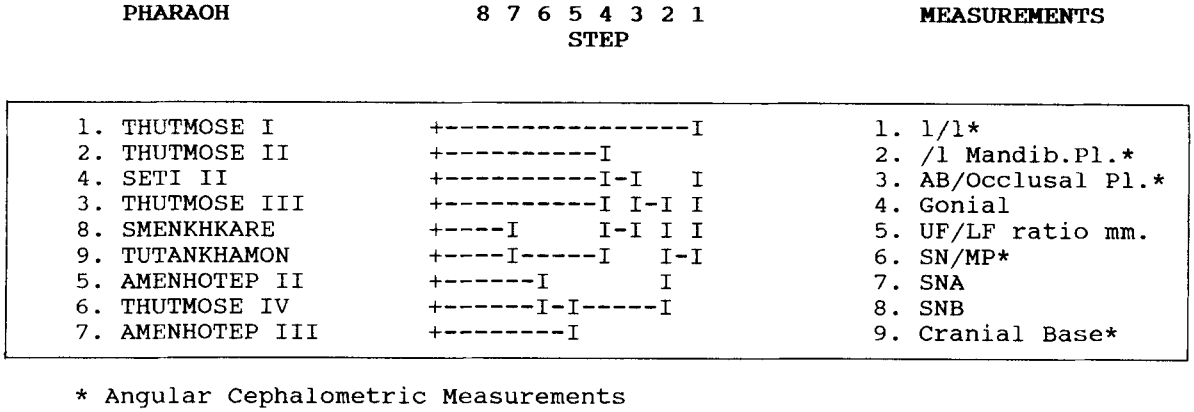

Figure 2. Dendrogram resulting from cluster analysis demonstrating biometric relationship between Tutankhamon and Smenkhkare.

Table 2. The pharaohs of the XVIII Dynasty[a].

Museum number	Pharaoh	Father/mother
6343	*Ahmose I*	Kamose or *Seqenenre Tao II*/ Ahhotep I or Ahhotep II
6344	*Amenhotep I*	Ahmose/*Ahmes Nefertary*
6345	*Thutmose I*	——/Senisoneb
6346	*Thutmose II*	Thutmose I/Mutnofret
	Hatshepsut	Thutmose I/Ahmes
6347	*Thutmose III*	Thutmose II/Isis
6348	*Amenhotep II*	Thutmose III/Meryetre Hatshepsut
6349	*Thutmose IV*	Amenhotep II/*Tiaa*
2088	*Amenhotep III*	Thutmose IV/Mutemwia
	Amenhotep IV	Amenhotep III/Tiye
1075	*Smenkhkare*	Akhenaton or Amenhotep III/——
	Tutankhamon	Akhenaton or Amenhotep III/——
	Aye	*Yuya/Tuya*
	Horemhab	———/———

[a] The mummies italicized are in the royal mummy collection.

Table 3 Identification and chronology of the XVIII Dynasty Royal mummies.

Historical identification[a]	Biological identification[b]
Amenhotep I	Amenhotep I
Thutmose I	Prince
Thutmose II	Thutmose II
Thutmose III	Thutmose III
Amenhotep II	Thutmose IV
Thutmose IV	Amenhotep II
Amenhotep III	Amenhotep IV *Akhenaten*
Skeleton KV 55	Smenkhare
Tutankhamon	Tutankhamon

[a]Identification by the priests of the XXI Dynasty (1085–945 BC), except for Tutankhamon.
[b] Identification based upon similarities/dissimilarities of the components of the craniofacial skeleton.

examined. This study in fact will be limited to the XVIII dynasty (Table 2).

Some of these mummies were obviously different from their predecessors or their successors. Thutmose I has all those craniofacial characters common to the Nubian people, i.e. skeletal-dental-alveolar prognathism. X-ray cephalograms indicate for the first time that there is little craniofacial similarity between the still unwrapped mummy of Amenhotep I and Thutmose I. Further X-rays reveal that the epiphyses of Thutmose I's knees are still patent, suggesting an individual not yet in his twenties. These biological parameters strongly contradict the identification of the mummy as Thutmose I. Further, the X-rays reveal that the arms of Amenhotep I were crossed at the time of burial, where as the arms of Thutmose I are in a pudendal position, a question proposed by Elliot Smith to be solved by X-rays in 1912 and noted by Derry in 1932.[4]

Ahmose has little resemblance to either Seqenenre Tao II or Amenhotep I and is not circumcised, unusual for the XVIII dynasty. Amenhotep II has a long ovoid face compared with the very short face of Thutmose III. Thutmose IV has a very fine featured delicate face compared with that of Amenhotep III. Smith states that, 'There is a most striking resemblance in face and cranial form between Amenthos II and Thutmosis IV, in spite of the fact that the general appearance of *strength and decision of character* in the face of the former are in marked contrast to the *effeminate weakness* of the latter. The shape of the head, with its curious sloping forehead and slender but prominent nose, is identical in these two pharaohs.'[5] In fact, Amenhotep III has a facial skeleton quite unlike all other Royal Mummies and resembles most closely that of the Statuary of Amenhotep IV. One of us (FH) has recorded that Amenhotep III's skull (maximum head length 195 mm) is two standard deviations too large for his body (slightly less than 5 ft or 149.64 cm).[6]

The skeleton of the mummy found in Tomb KV 55 (Smenkhkare) was reconstructed by Nasry Iskander in 1984 following the X-ray templates constructed by Harris, Hussien and Ingalls. Subsequent cephalometric measurements and cluster analysis revealed that of all the royal mummies Tutankhamon and Smenkhkare are most similar (Figure 2). Hussien has demonstrated that this mummy/skeleton is that of a slightly built male of about 35 years of age.[7]

Neither Tutankhamon nor Smenkhkare could have been the children of Amenhotep III or Akhenaton if the statues are at all representative of their physiognomy (Figure 3). Much has been made of the 'elongated' head of Tutankhamon, but when compared with other members of the XVIII dynasty, the head does not seem peculiarly different. From a biometric comparison, both Tutankhamon and Smenkhkare seem most similar to Thutmose IV. Certainly there is no similarity between Thutmose IV and Amenhotep III.

From the view point of *biometric* comparisons, the present identification and chronology of the XVIII Dynasty Royal Mummies by the Priests of the XXI Dynasty may be arranged better (Table 3). There are certain mummies that do not

Figure 3. Sculpture of Amenhotep IV (Akhenaten) from the Louvre.

follow the polygenetic model that a sibling is *not* totally different from a parent when considering multifactoral traits, such as the bony morphology of the craniofacial skeleton. Ahmose does not fit morphologically with either Seqenenre Tao or Amenhotep I. Thutmose I is not similar to Amenhotep I, but has typical Nubian morphology. Thutmost IV is a better biological fit between Thutmose III and Amenhotep II. Although no mummy of either the XVIII or XIX dynasties is similar to Amenhotep III, Amenhotep II would be the best candidate for a first degree relative.

Summary

The biological discontinuity of the XVIII dynasty represents both a puzzle and a challenge for the Egyptologist, the archaeologist, and the biologist. Lack of mummies of most queens of the XVIII dynasty, brother-sister marriage patterns (although infrequent and between half-sisters) and uncertainty of the paternity of any given pharaoh add to the difficulty of interpreting and ordering the chronology of the XVIII dynasty royal mummies.[8]

Finally, there are obviously missing members of the ruling families of the New Kingdom period of Egypt. It is more amazing that so many kings and queens were found from this period, when no rulers of any other great Egyptian period have been found at the present time. Nevertheless, there are in the Egyptian museum and even in the known tombs of the Valley of the Kings, mummies with no identification that may be identified eventually as known members of the royal families of the New Kingdom period. The application of genetic finger printing utilizing microsamples of hair or tissue debris offers an intriguing and powerful tool to examine the identification and chronology of the Egyptian royal mummies in the future.

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