

Evolutionary Changes In The Jaws And Teeth Of Homo Sapiens – In A Nutshell

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Abstract

Over the course of the evolutionary journey, the emergence of Homo sapiens as a distinct species in the human family is relatively a new thing. The rise of this intellectually superior species also came along with a change in the skeletal and bodily built. Hence, the jaws and dentition of Homo sapiens underwent evolutionary changes.

This article points out the distinct features of the jaws and teeth of Homo sapiens (anatomically modern humans).

Introduction

Modern humans (homo sapiens) are the only remaining human species to survive on our planet. but there was a time when other human species such as the homo erectus, homo neanderthalensis, etcetera also lived on earth.

The intellectual superiority of homo sapiens made it possible for the survival of our species into the present time. over the millennia, the body of modern humans continued to evolve due to various factors such as

change in the climate, change in diet, change in population density, etcetera. as a result, a change in the architecture of our facial skeleton, jaws and dentition was induced. the evolutionary changes caused the jaws, teeth and crania of modern humans to become gracile, delicate and smaller in comparison with our predecessors.⁴

The Hominini Tribe

The Hominini forms a taxonomic tribe of the subfamily Homininae. Hominini includes the genus Homo (humans) but excludes the genus Gorilla (gorillas). The tribe Hominini was originally introduced by John Edward in 1824.

Modern humans are the only surviving members of the tribe Hominini. The tribe Hominini consists of five genera.¹ The following are members of the tribe Hominini:

- Ardipithecus ramidus.
- Paranthropus aethiopicus.
- Paranthropus boisei.

- Paranthropus robustus.
- Praeanthropus africanus.
- Australopithecus africanus.
- Australopithecus anamensis.
- Homo erectus.
- Homo habilis.
- Homo heidelbergensis.
- Homo neanderthalensis.
- Homo sapiens (we are here).

Distinguishing Jaw And Dental Features Between Early Homo And Other Members Of The Hominini Tribe

In 1964 Louis Leakey, Philip Tobias and John Napier suggested that the face and mandible of the genus Homo should be smaller in comparison to that of the preceding Australopiths.²

The Australopiths had strong and robust jaws with exceptionally large teeth. In contrast early Homo had smaller teeth, jaws and a larger cranial capacity.²

Most of the fossilized remains of early Homo consist of teeth, jaws and skull fragments. Amongst the fossil records, teeth are the most abundant. Teeth contain an outer protective layer called enamel. Tooth enamel is made of a durable substance, hydroxyapatite, which is far better at withstanding the chemical and physical degradation that occurs during the fossilization process than bones are.²

Teeth also evolve and adapt relatively rapidly, thus even in absence of skulls and entire skeletons, just the shape of the teeth may be used to identify different species of the genus Homo (Homo habilis, Homo neanderthalensis, Homo erectus, etcetera).²

The suite of traits which are used to distinguish early Homo fossils from other members of the Hominini tribe include smaller teeth overall, relatively smaller molars and premolars compared to incisors, reduced

canines, thick enamel and a parabolic dental arcade. That is, the teeth are arranged in a horseshoe shape rather than a V shape or a U shape, as in early hominins and in non-human apes.²

A Quick Look At The Genus Homo

Sr. No.	Species	Discoverer(s) / First Describer(s)	Fossil Site	Year of Discovery
1.	Homo erectus	Eugène Dubois	Indonesia	1891
2.	Homo habilis	Louis and Mary Leakey	Olduvai Gorge in Tanzania	1960
3.	Homo naledi	Lee Berger	South Africa	2015
4.	Homo heidelbergensis	Otto Schoentensack	Heidelberg in Germany	1908
5.	Homo neanderthalensis	William King	Engis in Belgium	1829
6.	Homo sapiens idaltu	Tim White, Giday Woldegabriel and Berhane Asfaw	Herto Bouri in Ethiopia	1997

Major Cranial/Dental Features Traditionally Used To Diagnose Homo Sapiens

The following are the cranial/dental features used by paleontologists to identify fossils of Homo sapiens:^{3, 4, 5.}

- Neurocranial globularity.
- Facial (Maxillary) Retraction.
- Presence of canine fossa.
- Protruding chin.
- Accentuated curve of Spee.
- Reduced size of teeth.
- Anteriorly placed TMJ.

Maxillary Retraction And Canine Fossa

Early hominids and extinct human species showed bone deposition in their anterior face which was responsible for their characteristic prognathic facial profile. Bone growth remodeling is a key mechanism mediating the development of the facial skeleton. It arises from the interplay of osteoblasts which deposits

bone, and osteoclasts, which resorb mineralized matrix.

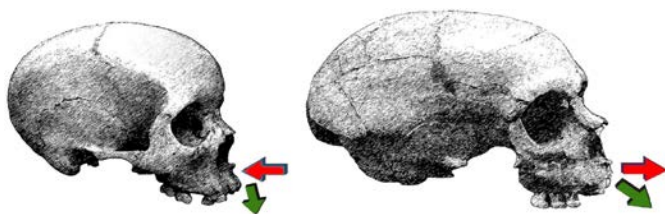
The developing face of *Homo sapiens* mostly presents bone deposition over the upper parts, however, the middle and lower face, mainly the anterior maxilla, are commonly dominated by bone resorption starting about a year after birth, which is maintained until adulthood.³

This resorption in the modern human face contributes to the development of key facial characteristics such as maxillary retraction and the development of the canine fossa.³

A study conducted by Lacruz et al, showed the difference in maxillary bone growth between *H. neanderthalensis* and *H. sapiens* which can be summed up as follows:³

The extensive bone deposits over the maxilla are consistent with a strong forward growth component in the Neanderthals. Whereas resorption over this region in the modern human face moderates forward displacement. Widespread deposition of bone in the Neanderthals combined with larger developing nasal cavities displaces prosthion downward and more anteriorly than in modern humans. In modern humans, forward displacement is more limited with resorption compensating the anterior cortical remodeling drift of prosthion.

The following diagram illustrates the difference in direction of maxillary growth in *Homo sapiens* and *Homo neanderthalensis*:



Homo sapiens

Homo neanderthalensis

Forehead

The forehead of *Homo sapiens* is nearly vertical as compared to a backward sloping forehead in earlier hominids. This can be attributed to the increase in size of the frontal lobes of the brain in *Homo sapiens*.

Chin

The protruding chin is one of the evolutionary features which distinguishes *Homo sapiens* from other human species. Researchers have hypothesized that the development of chin in modern humans occurred due to decreased dental use and mandibular shortening.⁴

Curve Of Spee

The third molars of modern humans have undergone a forward tilt during the course of evolution. This led to the curve of Spee being more accentuated in modern humans than in other hominids.⁴

Temporomandibular Joint

The position of the mandibular condyle changed over the millennia. Australopiths had a forwardly placed and raised temporomandibular joint. In *Homo erectus*, the TMJ was less raised and positioned backwards. Neanderthals had a wide ramus.

In *Homo sapiens*, the joint has moved forward. This happened probably due to change in food processing (cooking) and a change in diet.⁴

Dental Maturation

Studies on hominin dental growth rely on the fact that tooth crowns and roots form through rhythmic cellular activation and secretion, producing a permanent record of mineralized growth layers in enamel and dentin (perikymata). The remarkable production of a line coincident with birth in permanent first molars and all deciduous teeth (neonatal line) allows developmental time to be registered with an individual's actual age.⁶

A study carried out by Smith et al, which compared dental maturation between *H. neanderthalensis* and *H.*

sapiens showed that Neanderthal dentitions grew more rapidly than H. sapiens.

In fact, all previously existing hominids showed rapidly developing dentitions in comparison with modern humans, indicating faster physical and neural development. Hence, a delayed maturation of dental tissues is a feature typical of Homo sapiens.⁶

Conclusion

Modern humans through the course of evolution have developed a rounded cranium with a nearly vertical forehead, smaller teeth and jaws. Modern humans exhibit facial retraction along with the development of the canine fossa. A protruding chin is a characteristic feature of modern humans.

All these changes occurred over millions of years. Perhaps, more changes could be induced in the facial architecture of Homo sapiens in the coming future.

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