
ANTHROPOLOGY IN ORTHODONTICS

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Abstract: Anthropology is the scientific study of the physical, social and cultural development and behavior of human beings since their appearance on the earth. Anthropology studies the whole of the human condition, past, present, future, biology, society, language, culture. Dental anthropology is the study of teeth in a perspective beyond clinical science. That perspective includes the study of dental growth, theories on dental origin, primate dentition, and population variation. The paper provides important information and a systematic overview of the classification of anthropology: physical anthropology and cultural anthropology and their subdivisions. Different aspects and terminology of dental anthropology as dental development, dental pathology, dental morphology, forensic odontology and odontometry are analyzed and described in detail. The article focuses on the anthropometrics in orthodontics, cephalometric procedures and instruments of various measurements.

Anthropology not only provides an insight into the human evolution but also gives us a better understanding of the development of malocclusion and the probable etiology behind it.

Keywords: dental anthropology, anthropometric, cephalometric

1. ANTHROPOLOGY: DEFINITION, MEANING, NATURE AND SCOPE

Anthropology is the study of various elements of humans, including biology and culture, in order to understand human origin and the evolution of various beliefs and social customs. (Jacobs and Stern 1969). Anthropology studies the whole of the human condition, past, present, future, biology, society, language, culture. The term anthropology is a combination of two terms ‘anthropos’ and ‘logos’, the former meaning human and the later meaning discourse or science. Thus anthropology is the science or discourse of man. It is the science or discourse of human beings. Aristotle first used the term ‘Anthropologist’.

2. DEFINITIONS OF ANTHROPOLOGY

1. The concise oxford dictionary: study of mankind especially of its societies and customs; study of structure and evolution of man as an animal”.

2. Kroeber: “Anthropology is the science of groups of men and their behaviour and production”. 3. Herskovits: “Anthropology maybe defined as the measurement of human beings.”

4. Jacobs and Stern: “Anthropology is the scientific study of the physical, social and cultural development and behaviour of human beings since their appearance on this earth.”

Divisions of Anthropology and their relationships

Anthropology has been divided into two main branches: Physical anthropology and cultural anthropology. These two main branches have been again, sub-divided into several other branches.

Physical anthropology is concerned with man as a physical organism in “time” and “space”. Physical anthropology is study of the man through evolutionary processes and study of human populations. (Ralph L. Beals and Harry Hoijer 1965). This is a study of processes where by man developed from his non human ancestors and the continuing process of change still slowly altering his bodily form.

Physical anthropology has now been divided into the following five branches according to the specialization of study.

- *Human Genetics:* Human genetics is the branch of physical anthropology which studies the genesis of man. Human genetics is the study of human heredity. It studies the human physical characteristics that are transmitted through heredity from generation to generation.
- *Human Palaeontology:* Human palaeontology studies the old human skeletons of different stages. It also studies the history of earth evolution. According to Webster’s New International Dictionary, “Human

palaeontology is the science that deals with life of the past geographical periods. It is based on the study of the fossils remains as organisms.”

- *Ethnology*: Ethnology studies human races. Ethnology classifies human races and studies their physical characteristics. Ethnology is based upon anthropometry and biometrics, since both these measure racial characteristics.
- *Anthropometry*: According to Hershkovits, anthropometry may be defined as the measurement of man. Anthropologists have decided certain definite traits by the measurement of which human races may be classified. Anthropometry, again, has been classified into two branches, study of the physical structures of living human beings and study of human fossils.
- *Biometry*: In the words of Charles Winik, Biometry is the statistical analysis of biological studies specially as applied to such areas as disease, birth, growth and death”. Thus biometry is the statistical study of biological characteristics.

Cultural anthropology. Culture is the sum total of learned behavioral patterns. According to E.A. Hoebel. “The phase of anthropology that devotes its attention to the customs of mankind, is called cultural anthropology”. (E. Adamson Hoebel. 1976).

Cultural anthropology has been classified into the following two classes: prehistoric anthropology and social anthropology.

- *Prehistoric anthropology*, it deals with ancient cultures and with past phases of modern civilization. (Ralph L. Beals and Harry Hoijer 1965).
- *Social anthropology* is the study of social behavior especially from the point of view of the systematic comparative study of social forms and institutions.

Dental Anthropology is the study of teeth in a perspective beyond clinical science. That perspective includes the study of dental growth, theories on dental origin, primate dentition, and population variation. The first comprehensive review of research on primate dentition was by Krogman in 1927. (Alt. K., Brace C. & Turp J. 1998).

What do dental anthropologists do? (1) Genetically controlled variables such as tooth crown size and morphology are used to trace phylogenetic relationships and historic trends in size, shape, and number of teeth. (2) Crown wear and dental pathology give clues to dietary and cultural behavior. (3) Gross and microscopic defect analyses reflect disease and dietary stress. (4) Intentional cultural modifications of teeth reflect society and culture of people, both present and past. (5) Bite marks, distinctive patterns of occlusion and wear, missing and filled teeth, and radiographic landmarks make teeth pivotal in many cases of forensic identification. (6) The comparative anatomy of teeth provides crucial evidence for systematics (classification) and determining biological relatedness. (Chrysostomou, P. & Thompson T. J. U. 2016).

Beginning of dental anthropology is in eighties of 18th century, recognised in 20th century Founder of American journal of physical anthropology is Ales Hrdlicka. The term dental anthropology was used in early 1900s.

Different aspects of anthropology (applied anthropology) are Dental development, Dental pathology, Dental morphology, Forensic odontology and Odontometry. (Scott, G., & Turner, C. 1997).

Dental development. Tooth eruption standards which are relatively independent of general body growth and skeletal maturation are of great significance in the diagnosis and treatment planning of children with growth disturbances protein-calorie malnutrition (PCM)

Dental pathology. Dental caries – it is a pathologic condition of the teeth resulting in the decalcification of the dentin, enamel and the disintegration of the remaining organic material often leading to the loss of teeth. Caries susceptibility expresses the inherent or acquired proneness to caries. Low incidence of caries in the prehistoric as also in the living tribal communities – coarse and fibrous food products.

Dental morphology. Teeth are best preserved and most easily accessible anatomical system of the body. Pioneering studies are from Hrdlicka, Dahlberg, Campbell, Hellmen, Krogman, Moorrees etc. (Edgar, H. J. H. 2017).

1. *Supernumerary teeth or hyperdontia* - causes dental disturbances by interfering with normal eruption - either peg shaped or have large crown - Higher frequency in the maxilla - Campbell conducted a study on the skulls and living Australian aborigines. (1.8%)
2. *Carabelli's cusp or anomaly Von Carabelli* in 1842 Its occurrence – back to paleolithic man An elevation or tubercle on the lingual surface of the mesio-lingual cusp of the maxillary molars particularly the first one. This is a marker for differentiation between different ethnic groups.
3. *Shovel-shaped incisors* “shovelling” by Muhlreiter (1870) is a condition resulting from a combination of a concave lingual surface and elevated mesial and distal marginal ridges enclosing a central fossa in the upper and lower incisor teeth Hrdlicka (1911) had done pioneering work in dental anthropology and reported pronounced shovelling in the incisors of American Indians.

According to Hrdlicka there are 4 grades of shovelling:

1. Shovel- enamel rim has well developed fossa
2. Semi shovel- enamel rim is distinct but with shallower fossa
3. Trace shovel- enamel rim has distinct traces
4. No shovel- enamel rim has no fossa.

According to Hellman –marked, medium, trace, and absent.

4. *Diastema*: it is a space or gap present between the maxillary central incisors or between the lateral incisors and canines. Former – median diastema (combined with small lateral incisors or large labial frenum), latter – lateral diastema (found in anthropoid apes and certain fossil men).
5. *Crowding*: inheritance of large teeth from one parent and a small jaw from the other
6. *Cingulum or lingual cusp*: A shelf or swelling which is found on the tooth just above the central line. Site of development of many supernumerary cusps.
7. *Occlusion*: relationship between the masticatory surfaces of the maxillary and mandibular teeth when the mouth is closed. It depends of hereditary factors and environmental factors.

Forensic odontology. Deals with the identification and study of human teeth identification of a person involved in mass disasters (automobile/aircraft accidents, floods, building collapse and industrial hazards)

Odontology. Tooth size standards based on odontometry can be used in the age and sex determination of skeletal and also living population. Studies shows that males have larger teeth (mesio distal crown diameters); canines show greatest amount of sexual dimorphism; Europeans have smaller teeth than mongolians or other racial groups.

Terminology in dental anthropology: Homodont, Heterodont, Monophodont, Diphyodont and Polyphyodont. (Scott, G., & Turner, C. 1997).

Crown Form: (Salazar-Ciudad I., Jernvall J 2010).

Bunodont (Gr = mound or hill) teeth have coneshaped tubercles or cones; they are low crowned with well-developed roots. example is the posterior teeth in the pig.

Selenodont (Gr = the moon) teeth have cusps transformed into half-moon shapes. The concave side faces laterally in the upper jaw; lingually in the lower jaw. example is in the cheek teeth of sheep.

Sectorial (L = secare to cut) teeth are blade-like teeth adapted to cutting the diet into pieces and swallowing them whole.

Lophodont (Gr = crest) molars are ridged teeth that have transverse ridges as in the tapir. *Bilophodont* molars have two sets of transverse ridges.

Polylophodont molars have many ridges as seen in the elephant molar;

Brachyodont (Gr = short) teeth have low crowns and welldeveloped roots. This condition is seen in humans

Hypsodont (Gr = height) teeth have long crowns and short roots as seen in the horse. In them, it is a functional adaptation for continuous wear sustained by chewing grass with a highabrasive silica content. Tusks are incisors or canines of continuous growth that protrude beyond the lips when the mouth is closed.

Anthropometry is defined as the systemized art of measuring and taking observations on man, his skeleton, his brain or other organs, by the most reliable means and methods for scientific purposes Ales Hrdlicka. The fundamental rule in anthropometry is to measure only those parts which are needed to throw light upon the problem being investigated. (Algee-Hewitt, B. F. B. 2016). Anthropos means human and metron means measure. Anthropometry represents the typical and traditional tool of physical anthropology. According to Johann Friedrich Blumenbach there are 3 types of head form 1. Square 2. Long 3. Laterally compressed

4. ANTHROPOMETRICS IN ORTHODONTICS

The quantification of man is a function of modern biology. (Algee-Hewitt, B. F. B. 2016).

Anthropometry+ craniometry =cephalometry (Hanihara, T., & Ishida, H. 2005).

Anthropometric and cephalometric procedures and instruments are:

Measuring tape- Flexible steel tape graduated in millimeters.

Anthropometer- Hollow sliding rods, graduated in millimeters, used for taking various measurements including vertical and transverse body measurements.

Sliding Calipers -This is employed to measure head and face diameters.

Sliding Compass- To measure smaller diameters of the head.

Head Spanner- To determine height of the head.

Various measurements:

Head Length- The maximum glabella occipital diameter. Is obtained with the spreading calipers. This dimension is taken from the most prominent point on the glabella to a point on the vertical line bisecting the occiput. (Hanihara, T., & Ishida, H. 2005).

Head breadth - is the greatest transverse diameter measured in the horizontal plane above the supramastoids and the zygomatic crests. This measurement is taken with the spreading calipers.

Head circumference - is taken with a steel tape through the most prominent part of the occiput and just above the supra-orbital ridges. (Hanihara, T., & Ishida, H. 2005).

Head Height

Facial Height- This measurement is taken with the spreading calipers.(Hanihara, T., & Ishida, H. 2005).

- Total facial height -nasion (N) to Gnathion (Gn)
- Upper facial height -nasion (N) to Prosthion (Pr)
- Dental height -from prosthion to infradentale.
- Lower facial height - infradentale to gnathion (Gn).

Facial Width. This measurement is taken with the spreading calipers.(Hanihara, T., & Ishida, H. 2005).

- Bizygomatic -zygion to zygion.
- Bigonial - gonion to gonion.
- Maximum Mouth Breadth - The maximum breadth of the mouth when the face is in a relaxed condition (from cheilion to cheilion).

CRANIOFACIAL INDEXES Definition- An index in anthropometry is the ratio of a smaller to a larger measurement taken as equivalent to 100 and expressed in terms of a percentage. To determine the proportional relation of the breadth (width) of the head to its length (depth), it is equated to the value of 100, and the breadth then is expressed as a ratio of 100. (Caple, J. M., & Stephan, C. N. 2016).

Cephalic index is grouped under three categories defined by Martin as follows: Dolichocephaly Mesocephaly and Brachycephaly 75.9 76.0 - 80.9 81.0

The cephalic index at the 4th month of intrauterine life is very high, since until this time width grows faster than length. After this period the ratio falls rapidly, The cephalic index decreases before birth and the head is relatively dolichocephalic (anteroposteriorly longheaded).

The facial index- it is the ratio of the length of the face to the width. The index of the upper face to the lower face may be obtained in the same manner. The index increases slightly annually as the child grows; the face becomes relatively broader.

The palatal index -is the ratio of the breadth to the length. Breadth of the palate is taken from the mesial pits of the right and the left first molars. Length is taken from the inner alveolar point between the maxillary central incisors to the posterior nasal spine as seen on the roentgenogram or dry skull.

Facial form

Each person's face is a custom made original. Anthropologists can reconstructs the face from a dry skull. The biologic rationale underlying common variations : 1. Different facial types 2. Male and female developmental facial differences 3. Child and adult facial differences

Head form

There are two general extremes:dolicocephalic (long,narrow)-leptoprosopicand brachycephalic (wide, short, globular) -euryprosopic(Caple, J. M., & Stephan, C. N. 2016).

Dolicocephalic: Nose is longer, protrusive with aquiline type of nasal contour,convex profile,cheek bones are less prominent, longer, narrower, and deeper maxillary arch and palate, downward and backward rotation of the mandible and receding chin.

Brachycephalic:Nose is protrusively shorter (rounded tip), prominent cheek bones, concave / straight profile,wider, shorter and more shallow palate and maxillary arch, mandibul is more protrusive and more prominent chin.

Dinaric head form is typical for Dinaric Alps,Ex Yugoslavia - "Brachycephaliseddolicocephalic". There are flattened occipital regions, bossing of parietal regions, triangular configuration of skull, fore head is sloping and the profile tending towards orthognathic. Mandible tends to be less retrusive

Male versus female features

Size and configuration of the nose, fore head, cheek bones and upper jaw look more prominent in females.

Child versus adult features

Child's face is not a miniature of the adult face. Head form sexual dimorphism with forehead, face appears diminutive in child, nasal part is small,eyes appears wide set,dentition is primary and permanent, mandible is small and chin is incompletely formed.

5. CONCLUSION

Anthropology not only provides an insight into the human evolution but also gives us a better understanding of the development of malocclusion and the probable etiology behind it.

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