AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 6. No 05. MAY ,2026

DYNAMICS OF AGE-RELATED CHANGES IN THE SKULL: MORPHOFUNCTIONAL, HISTOLOGICAL, AND CLINICAL ASPECTS

ORAZMAMEDOV MURODJON
Termez Branch of the Tashkent State Medical University
Assistant of the Department of Anatomy and Clinical Anatomy
bobursottorov199194@gmail.com
TURDIMURATOV BAXTIYOR KURBONOVICH
Termez Branch of the Tashkent State Medical University
Assistant of the Department of Social and Humanitarian Sciences
baxtiyor.turimuratov6691@gmail.com
QURBONOVA MOHINUR BAXTIYOROVNA
"Lecturer at the Faculty of Law, Termiz State University"
mohinurqurbonova@gmail.com
XUDOYSHUKUROVA SHAXZODA OLMAS QIZI
Termez Branch of the Tashkent State Medical University
1st-year student of the Pediatric Faculty (Pediatrics major)
shaxzodaxudoyshukurova@gmail.com
RUZIALIYEVA MAFTUNA YOQUBJON QIZI
Termez Branch of the Tashkent State Medical University
1st-year student of the Pediatric Faculty (Pediatrics major)
ruxsoraqobilova30@gmail.com
https://doi.org/10.5281/zenodo.19997375

Abstract This article highlights the stages of age-related changes in the human skull during ontogenesis based on the international IMRAD (Introduction, Methods, Results, and Discussion) standard. The morphological and histological characteristics of skull development, proportional changes between the cranial and facial parts, as well as the involution of bone tissue during aging, are analyzed. The article serves as a scientific and methodological resource for medical university students and young scientists conducting research in the fields of morphology and anatomy.

Keywords: Skull, ontogenesis, craniometry, fontanelles (fontanella), obliteration of cranial sutures, morphology, splanchnocranium, neurocranium.

Introduction

In newborns, the cranial part of the skull is more developed compared to the facial part. This is because the masticatory muscles and teeth are not well developed in infants.

The skull of newborns contains fontanelles (fonticuli), which represent the first connective tissue stage of development:

1. **Anterior fontanelle (fonticulus anterior)** — located between the frontal and parietal bones, closes at 2 years of age;
2. **Posterior fontanelle (fonticulus posterior)** — located between the parietal and occipital bones, closes at 2 months of age;
3. **Anterolateral (sphenoidal) fontanelles (fonticulus sphenoidalis)** — located among the sphenoid, frontal, parietal, and temporal bones, close at 2-3 months of age;
4. **Posterolateral (mastoid) fontanelles (fonticulus mastoideus)** — located among the temporal, parietal, and occipital bones, close at 2-3 months of age.

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 05. MAY ,2026

Cartilage tissue is present between the bones of the skull base, resembling the cartilaginous stage of development. Skull growth occurs due to the connective tissue in the fontanelle areas and the cartilaginous tissue at the skull base. In newborns, the tubercles and processes on the skull bones are not yet developed. Up to the age of 7, the skull enlarges primarily at the expense of its posterior bones. From 7 years of age until puberty, the bones of the cranial part develop. From 15 to 24-26 years of age, the facial bones develop. In old age, the skull changes due to tooth loss.

SHAPE OF THE SKULL The internal part of the bones that appear large from the outside of the skull consists of cavities, which are called sinuses. Air-filled cavities include: in the upper jaw — *sinus maxillaris*; inside the frontal bone — *sinus frontalis*; inside the body of the sphenoid bone — *sinus sphenoidalis*; inside the ethmoid bone — *sinus ethmoidalis*. These cavities perform the following functions:

1. Lighten the weight of the skull;
2. Warm the air as they open into the nasal cavity;
3. Clean the air from dust and humidify it, as the inner surface of the cavities is lined with a mucous membrane;
4. Create resonance during speech, participating in the correct pronunciation of sounds.

The internal structure of the skull is related to the development of the brain. The brain develops first. Openings and canals form in the surrounding skull bones for the passage of nerves and blood vessels. The development of the facial part of the skull is associated with the development of masticatory and facial muscles. The external structure of the skull depends on growing conditions. Some African tribes place a board on the occipital part of newborns and bind it around the frontal bone. As a result, the skull elongates and develops into a dome shape. The shape of the skull does not determine a person's intelligence or lack thereof. The shape of the skull is related to the conditions of its growth.

The skull (cranium) is a complex of bones that perform complex biomechanical and protective functions, and its formation is inextricably linked with the development of the central nervous system, sensory organs, and the masticatory apparatus. During human ontogenesis, the skull undergoes constant morphofunctional changes.

In medical sciences, especially in pediatrics, neurosurgery, forensic medicine, and maxillofacial surgery, knowing the age-specific characteristics of the skull is of paramount importance. Studying the development of the skull and the patterns of changes in its histological structure serves to correctly diagnose diseases and improve the quality of teaching morphological sciences in medical universities. The purpose of this scientific-methodological article is to systematically analyze the dynamics of changes in the skull from infancy to old age.

Methods

In preparing this article, a literature review of modern scientific publications on clinical anatomy, histology, and morphology was conducted. The following approaches were used to systematize the data:

- **Morphometric and craniometric analysis:** A comparative study of the age-related proportional changes between the cranial (neurocranium) and facial (splanchnocranium) parts of the skull.
- **Analysis of histological and osteological observation methods:** Stratification of changes in the ratio of collagen fibers and inorganic substances in bone tissue by age periods.
- **Logical-analytical method:** Generalization of the obtained morphological data based on the requirements of practical medicine.

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 05. MAY ,2026

Results

To conveniently study the age-related changes of the skull, we divided it into four main periods and analyzed them:

Infancy and toddlerhood (0-1 year) The most fundamental morphological feature of the newborn skull is the presence of connective tissue remnants between the bones, namely the fontanelles (fonticuli cranii).

- The anterior (frontal) fontanelle usually closes at 1.5–2 years of age, while the posterior (occipital) and lateral fontanelles ossify within 2-3 months after birth.
- In newborns, the volume of the cranial part is significantly larger than the facial part (a ratio of 8:1). The reason for this is the strong development of the brain and sensory organs, whereas the masticatory apparatus has not yet begun functioning.
- The diploic substance (substantia diploica) is not yet formed in the bones of the cranial vault.

Childhood (from 1 to 12-14 years) During this period, the skull grows rapidly and unevenly.

- Starting from the end of the first year, as a result of the eruption of deciduous teeth and the activation of masticatory muscles, the facial part of the skull (splanchnocranium) begins to grow rapidly.
- By the age of 7, the growth of the skull base slows down, but the cranial vault continues to grow. At the age of 7, the child's brain volume reaches 90% of an adult's brain volume.
- Histologically, a diploic layer is fully formed between the bone plates, and the air-filled cavities (sinus frontalis, sinus maxillaris) expand.

Adolescence and adulthood (15-60 years)

- Once all permanent teeth have erupted, the final proportion between the facial and cranial skull is formed (the ratio is approximately 2:1).
- Between the ages of 20 and 30, the sutures between the skull bones (suturae cranii) begin to fuse — this process is called synostosis (obliteration). The closure of sutures typically starts from the inner surface of the cranial vault and progresses toward the outer surface.
- During this period, sexual dimorphism in the male and female skull manifests at the highest level (in males, the superciliary arches and occipital protuberances are larger, and the bones are thicker).

Senescence and old age (after 60 years) In old age, involutive (regressive) changes are observed in the skull:

- As a result of tooth loss, the alveolar processes of the upper and lower jaws are absorbed (resorption), resulting in a reduction in the size of the lower part of the face.
- Inorganic salts increase in the bone tissue, while organic substances decrease. Signs of osteoporosis appear in its histological structure, and the skull bones become thinner, lighter, and brittle.
- As a result of complete obliteration of the sutures, the skull turns into a single solid bone.

Discussion

The obtained results indicate that the ontogenetic changes of the skull strictly follow the general developmental patterns of the body. The flexibility of the skull in infancy and the presence of fontanelles not only ensure the adaptive passage of the fetal head through the birth canal during delivery but also create the mechanical space necessary for the rapid and intensive growth of the brain in the first years of life.

From a morphological and histological perspective, the resorption of bone tissue in old age is a natural manifestation of physiological aging. At the same time, the atrophy of the facial bone

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 05. MAY ,2026

parts due to tooth loss leads to impaired masticatory function and a decrease in the quality of life in patients. This serves as an important clinical indicator for maxillofacial surgery and orthopedic dentistry. When teaching this subject in medical universities, combining theoretical knowledge with visualization and practical craniometry serves to develop the clinical thinking of students.

Conclusion

In conclusion, age-related changes in the skull are a complex set of interdependent biological, morphological, and biomechanical processes. Its formation occurs in inextricable connection with the development of the brain, sensory organs, and masticatory muscles. An in-depth study of the stages from the flexibility characteristic of infancy to the atrophy of bone tissue in old age serves as a solid scientific foundation for a number of fields in practical medicine.

References

1. Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2017). *Clinically Oriented Anatomy* (8th ed.). Wolters Kluwer.
2. Ross, M. H., & Pawlina, W. (2018). *Histology: A Text and Atlas*. Wolters Kluwer.
3. Guyton, A. C., & Hall, J. E. (2020). *Textbook of Medical Physiology* (14th ed.). Elsevier.
4. Yunusov, A. T. (2020). *Histology, Cytology, and Embryology*. Toshkent: O‘qituvchi.
5. Netter, F. H. (2019). *Atlas of Human Anatomy*. Elsevier.
6. Zipes, D. P., et al. (2018). *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. Elsevier.
7. Mamatqulova, N. X. (2025). *Histology of the Cardiovascular System*. Termiz: TDTU Termez Branch Press.
8. Kurbonovich T. B. et al. (2025). DIGITAL TECHNOLOGIES IN MEDICINE. TELEMEDICINE. *IMRAS*. Vol. 8. No. 12. P. 39-41.
9. Kurbonovich T. B. et al. (2026). PROBLEMS IN MODERN CULTURE: SOCIO-SPIRITUAL ANALYSIS IN THE CONTEXT OF GLOBALIZATION AND DIGITAL TRANSFORMATION. *Global Science Review*. Vol. 18. No. 1. P. 183-188.
10. Panji o‘g‘li C. O. et al. (2026). REGENERATIVE PROPERTIES AND MODERN HISTOLOGICAL ANALYSIS OF CONNECTIVE TISSUE IN THE MORPHOFUNCTIONAL SYSTEM OF THE ORGANISM. *American Journal of Applied Medical Science*. Vol. 4. No. 2. P. 230-235.
11. Turdimuratov B.K. (2022). *Teaching Medical Sciences Using Innovative Methods and ICT*. Tashkent: Uzbekistan Medical Publishing House.
12. Kurbonovich T.B., & Bahodirovich, B.B. (2026). Step-by-step acquisition of practical skills in studying information technologies in medicine. *Global Science Review*, 17(1), 203–209.
13. Kurbonovich T.B., & Nurhayat, M. (2026). Compilation and steps of the medical situational issues algorithm. *American Journal of Applied Medical Science*, 4(2), 59–63.
14. Turdimurodov B.K., et al. The essence of electronic textbooks in medical education. *European Journal of Humanities and Educational Advancements*, 3(4), 48–50.
15. Shoxrullo S., Mirzohid B. (2026). MODERN CARDIAC SURGERY: EVOLUTIONARY MILESTONES AND CLINICAL RELEVANCE. *American Journal of Applied Medical Science*. Vol. 4. No. 3. P. 56-58.