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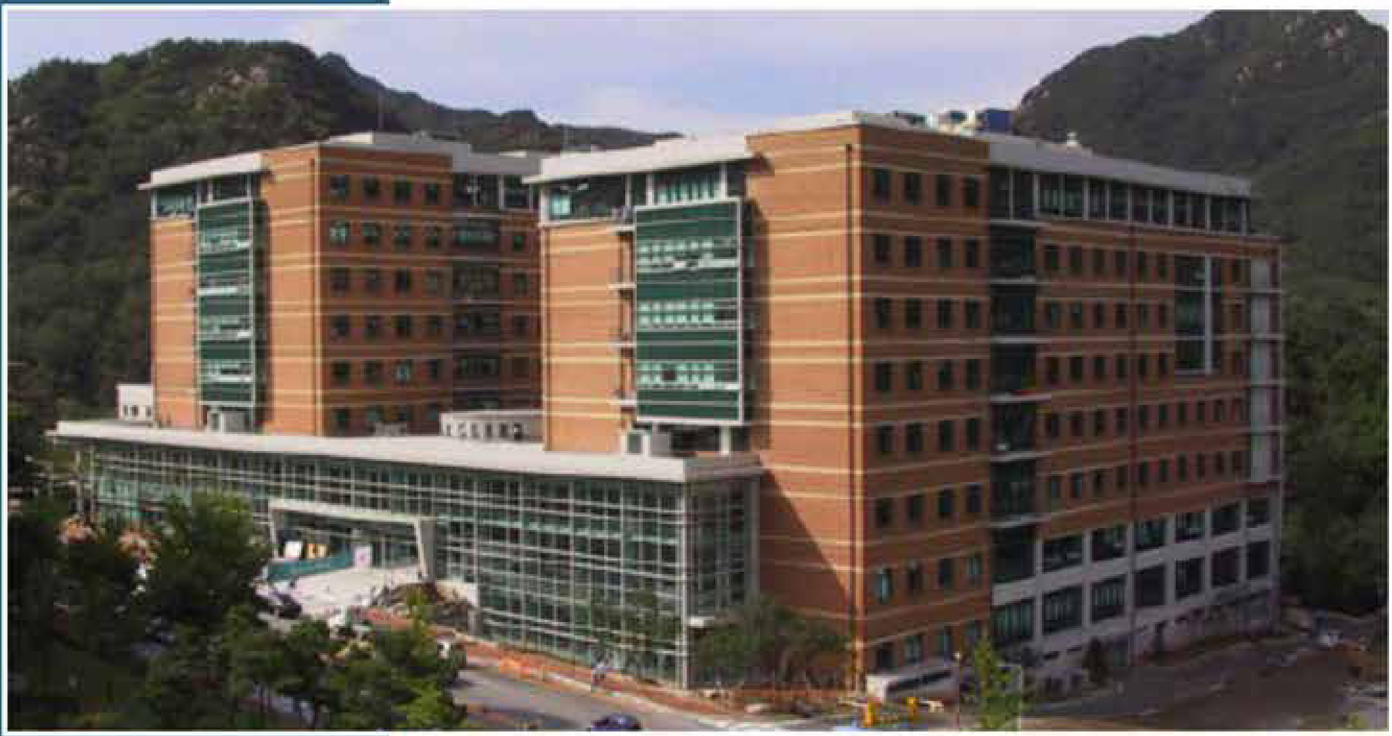

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Analysis of the canals' phylogenetic development of the human facial skeleton with the lepidic tissue

Abstract: The article deals with the canal development of the facial skeleton. During the period of evolution a part of secretory and lingual vascular canals connected in the primary nasal cavity of the land vertebrates with the environment; due to this their sides were covered by epithelium. Canals which open to the soft tissues have a connective tissue membrane.

Keywords: nasopalantine, wing palantine, nasolacrimal, wing-shaped canals, human skull, animal skull, phylogenesis.

Topicality of the research. Cranial facial nerves pass through the skull base. While going out of the skull some nerves place in the epithelial covering or get into the inter-bone canals, in fact some of them are covered by an epithelium (nasolacrimal, wing-shaped, nasopalantine), others by connective tissue (wing palantine, intraorbital, upper alveolar). The question of origin and applicability of the sulcular epithelium is not clear yet and to our mind can be clarified with the help of comparative anatomical and paleontological data.

The objective of the research. Define possible reasons of the epithelial covering development.

Materials and methods. Data of the comparative anatomy of the animal and human. Data analysis of the skull phylogenetic development.

Results of the investigation. An olfactory analyzer is one of the oldest phylogenetical organs in animals. While visual analyzer is on the exterior skull surface, the olfactory and gustatory are placed in the nasal and mouth cavities so they are partially hid, isolated from direct contact with the environment. Olfactory analyzer is that important in some animals that it sometimes covers the greater part of the brain. Thus, in otters with a highly developed olfactory system more than a half of the brain inner surface is an olfactory organ. Even lower vertebrates have paired olfactory organs looking as sac-like cavities with the folds of perceptive epithelium [1 p.144; 2 p. 201]. In fish such organs actively function, less in reptiles, though they develop a vomeronasal organ. Thus, reptiles being inable to cover big distances don't need to have strong olfactory organs which is balanced by warm analyzers of parirhinal pits (pit viper) and vomeronasal organ for defining pheromones while close contact with animals. Mammals gain distinct olfaction though many of them preserve pheromones' percepting ability and vomeronasal organ (Jacobson's organ). In the structure of the nasopalantine canal there is a cartilaginous tube which is a pheromone conductor. Such tube in some animals (lizards, snakes, oxen, cows, horses) has a direct outlet in the mouth cavity together with the nerve vascular bundle of the nasopalantine canal. Opening of the nasopalantine canal is accomplished by flehmen (a behaviour whereby an animal curls back its upper lip exposing its front teeth, inhales with the nostrils usually closed and then often holds this position for several seconds). This is how molecules like pheromones get into a vomeronasal organ which is very important in recognizing each other, cubs, sexual partners and also fremd and dangerous animal species. Besides, liquid filling the vomeronasal organ is periodically ejected into the mouth cavity through cartilaginous channels running through the nasopalantine canal [1, p. 156]. Thus, such channel and canal joining directly with the mouth cavity should be covered with epithelium; in the upper section – epithelium of the nasal cavity, in the lower section – mouth cavity.

Wing shaped canal (Vidien) also has an epithelial covering which is probably caused by its joining with the nasal and oral cavity in amphibians and reptiles with the undeveloped secondary palate. Canal development is connected with the development of the fixed cranial bone joints in phylo- and ontogenesis. It's known that in lower vertebrates cranial bone joints are moveable and represent a so-called kinesthetic skull, which means the skull of the vertebrate animals with the moveable joints. In fish upper mandible complex is moveable comparing to the axoidean (brain) skull. In some species of fish and reptiles there is moveable joining between two sections of the brain skull - etmo-sphenoidal and optico occipital. In the land vertebrates with the developed secondary palate these two sections joint together. In humans skull sutures do not joint completely and they stay moveable to some extent which can be measured by a special device [4 p. 56; 5].

Skull development is connected with improvement and preserving of perception organs like visual, auditory, olfactory. Such formations develop neurocranium which serves to protect central nerve system.

Front section of the digestive tract is presented by jaws (Visceral skull) joined with the brain skull. In fish the base of the brain skull is presented by a couple of sphenoidal bones (main, front, side, sphenoid).

In fish visceral skeleton palantine and pterygoid bones adjoin to the upper section of the zygomatic arch. Further the arch doesn't function like jaws anymore and the investing bone starts functioning like an upper jaw; the investing bone is developing in the upper lip – premaxillary and maxillary bones where teeth already developed.

Land vertebrates have much more developed jaws as jaws and bones around them (pterygoid, palantine, parasphenoid) are more movable, according to this bundles of trifacial and facial nerves in visceral skull are mainly situated in soft tissues and only after the secondary palate development there happens their tight adjoining to the brain skull and there they are placed in the canals (pterygoid, wing palantine, nasopalantine) [6;7].

In lower land vertebrates a roof of the mouth cavity if developed by a bottom of the skull itself. The cavity sides develop a parasphenoid paired vomers, square cartilage with pterygoid and palantine bones. And only the exterior edge is formed by premaxillary and maxillary bones. Parasympathetic bundles of the trifacial nerve through the pterygopalantine ganglion and Vidien nerve not locked in the pterygoid canal innervate mucous glands of the mucous membrane and lacrimal glands. Tears and mucous are produced for moisturizing the content of the primary mouth cavity in land vertebrates.

Direct contact of the Vidien nerve and mucous membrane requires epithelial covering of the bone sides where the nerve is. This probably can explain the origin of epithelium in the Vidien nerve canal.

Nasolacrimal canal is phylogenetically the oldest and its connection with the primary oral nasal cavity in the land vertebrates initially required epithelial covering as a canal contacting the environment [8;9].

Pterygopalantine canal doesn't have any secretory functions. It has big and small sensitive nerves which innervate the mucous membrane of the soft and hard palate, and also small salivary glands. In this canal on the level of the lower nasal turbinate run nerves from the mucous membrane of the lower, middle nasal passages and maxillary sinus [1; 3 p. 302; 10; 11]. Such group of nerves of the pterygopalantine ganglion develops sensible bundle and practically in all animals was situated in the soft tissues of the primary and secondary palate, didn't contact with the environment and the pterygopalantine canal didn't need epithelial covering.

Discussion of the results. Difference of the morphological structure of some human canals opening in the oral nasal cavity is characterized by epithelial and connective tissue covering its sides. With the help of comparative anatomical and paleontological methods we can investigate peculiarities of the skull, nose, mouth cavity development in water and land vertebrates. Development of the primary oral nasal cavity in land vertebrates with the movable bone of the kinesthetic skull created special conditions for the olfactory function, grasping and swallowing food. Thus, some secreting organs connecting with the oral nasal cavity practically contacted the environment which required additional protection. That is why nasolacrimal, nasopalantine, and canal of Vidien nerve have epithelial covering. Pterygoid palantine canal opening in the soft tissues has connective tissue membrane.

Conclusions

1. Canals of the human facial skull having phylogenetically based connection with the environment through the primary oral nasal cavity have an epithelial covering.
2. Canals of the vascular bundles of the facial skull connecting with the soft tissues are usually covered by connective tissue.

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