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Spiral Theory of the Human Body: The Human Skeleton as a Spiral

Teoría Espiral del Cuerpo Humano: El Esqueleto Humano como una Espiral

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SUMMARY: The accumulated amount of information about human morphology is enormous and this leads to a suitable environment for a new qualitative leap in the understanding of the human body. The Spiral theory of the human body (STHB) offers a new approach to describing the human, based on systematic thinking and modern understanding of physics and anatomy. The purpose of this report is to validate this theory from the perspective of the human skeleton. The human skeleton is located behind the center of the body and is the innermost part of the musculoskeletal system clearly expressing spiral qualities. Most axioms of the STHB could be validated by the human skeleton and locomotor apparatus and it is a good anthropological demonstration of the typical human characteristics that distinguish it from the animal world.

KEY WORDS: Human; Skeleton; Spiral; Theory; STHB; Bones.

INTRODUCTION

The accumulated amount of information about human morphology is enormous and this leads to a suitable environment for a new qualitative leap in the understanding of the human body. The spiral theory of the human body (STHB) (Pirovski & Genov, 2021) offers a new approach to describing it, based on systematic thinking and modern understanding of physics and anatomy.

The great Goethe was not only a poet, but also a naturalist who dreamed of creating a unified doctrine of the form, formation and transformation of organic bodies and introduced the term "morphology". He noticed the spiraling tendency of most natural forms and called the spiral the "curve of life". Spiral constructions abound in living forms, from the simplest virus to the parts of the human body, the shells of a snail, the nautilus, even plankton, the spider weaves its web spirally; the horns of some herbivores are curved symmetrically in opposite directions; the tails of the chameleon and the dragonfly spiral, the frightened herd of reindeer spirals; people's hair curls in a spiral at different frequencies, a human being has a pronounced spiral curve from head to toe. All bones are twisted and curved, and an attempt has been made to build a systematic approach to the description of the macro spirals in the human skeleton. The purpose of this report is to validate this theory from the perspective of the human skeleton. Other authors also pursue improvement of the understanding of the shape and symmetry of the skeleton (Zheng *et al*., 2015), and new taxonomy for that (Cornea *et al*., 2005). The structure of the bones has been extensively investigated, however the research continues aiming to provide new insight into the structural integrity of bone, osteology, forensic medicine and archaeology and inspire the design of novel biomaterials (Zhou *et al*., 2022).

MATERIAL AND METHOD

Normal human skeletons preparations used for teaching human anatomy in the Medical faculty, Anatomy department, Trakia University; Literature overview.

Descriptive analysis. The descriptive method of analysis is a research approach to describing the characteristics of phenomena or objects without looking for causal relationships. The main purpose of descriptive analysis is to provide an accurate and systematic picture of observed phenomena. The purpose is to describe existing conditions, behaviors, relationships, or other aspects of the object of study. After the data is collected, it is analyzed to identify patterns, trends and specific characteristics. We used statistical methods for quantitative data or thematic analysis for qualitative data.

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RESULTS

The skeleton as a system has an invariable spiral shape, and is evidence of the spiral structure of the human body, confirming the axioms of the spiral theory of the human body. The microstructure of the bones repeats the macroscopic shape of the bones, and forms osteon canals and trabeculae. The bone beams (trabeculae) that make up the bone tissue are located spirally, along the lines of force that are formed when the growth force opposes the forces that oppose it (gravity, the weight of the atmosphere, loads, sports, etc.) (Hammer, 2015). At the beginning of life, centripetal spirals predominate, and at the end - centrifugal ones (Holcombe *et al*., 2017) (Fig. 1).

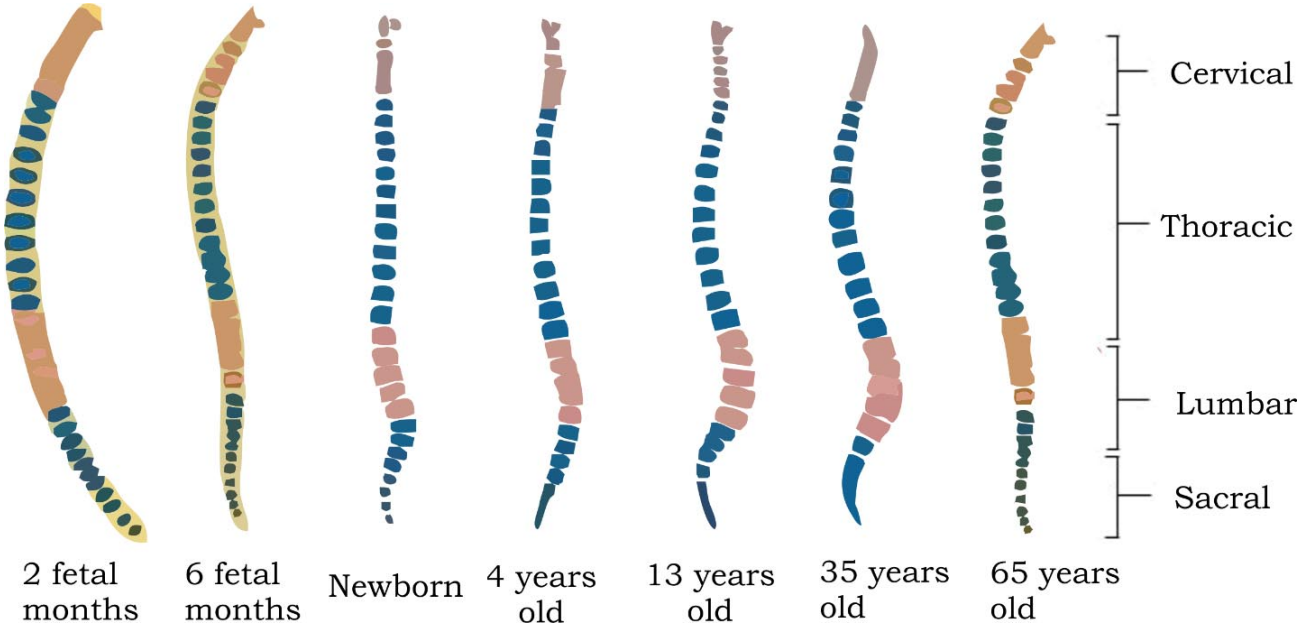

Fig. 1. Gradual unfolding of the spine as a centripetal spiral, with its subsequent reverse development and flattening. Author: N. Pirovski, 2024.

All bones in the body are curved like arcs and twisted, forming macro spirals located perpendicular to the earth's surface. The clavicle is the only long bone that lies horizontally when viewing the body in a normal anatomical position. However, when we have a functional position with raised arms, which is used much more often than the position of the anatomical norm, this ceases to be an exception and is in agreement with the spiral construction. It can be concluded that the upper limb is morphologically intended to be in a raised position, i.e. to be functional and working, not just hanging next to the body.

The center of the body is a negative space that is located horizontally at the margin between the thorax and the abdominal cavity, which cyclically pass through it with the movements of the diaphragm. It is located along the midline of the sagittal plane and the middle axillary line, which is the middle of the frontal plane. Not a single bone is located there. The closest bone is the 10th thoracic vertebra, which we place as the center of the skeleton, as it is the bone closest to the center of the body. The bones are arranged successively in categories according to their distance from the center of the body, each successive scale being separated from the previous one by a joint. This is a new way in which the discreteness of human function manifests itself at the skeletal level. The first scale is the vertebrae.

Systemically examined, the 10th thoracic vertebra is centered on the vertebral foramen and has two processes in each plane - a total of six. By classification it is an irregularly shaped bone, but irregular by what standard? If we assume that each structure tries to occupy as much as possible the volume provided to it, then the standard form is a sphere. And all parts of our body are originally developed from a sphere. In the process of development, due to compression, pulling from surrounding structures and apoptosis (programmed cell death), they acquire their characteristic shape. So the vertebrae, as well as all other irregularly shaped bones, are those which fit well into a sphere, and by logic of this exposition we shall call them regular bones. In contrast, flat ones fit well in a rectangle and the long ones in a cylinder. Figure 2 demonstrates the shape of the vertebra compared to basic geometric shapes.

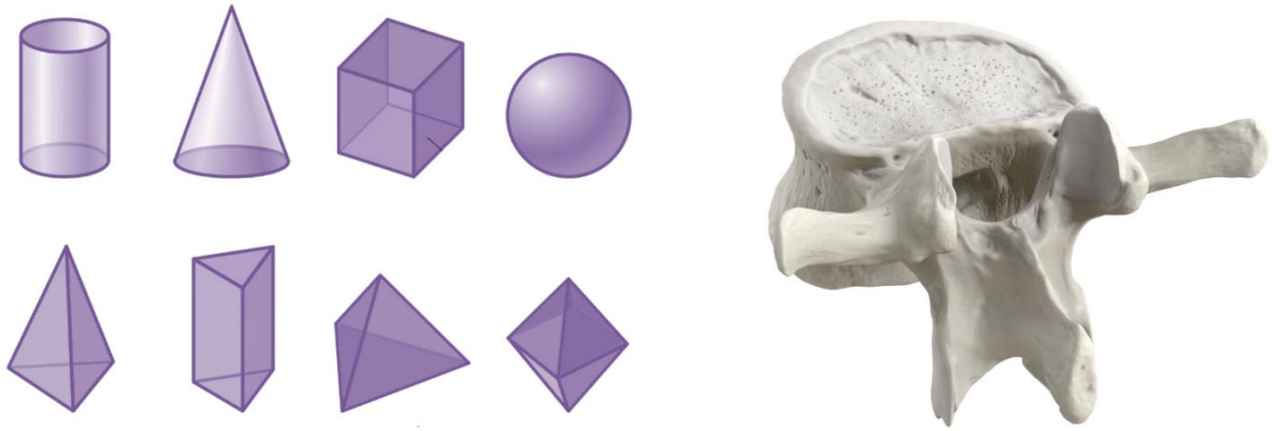

Fig. 2. The oblique back view of the 3rd lumbar vertebra compared to basic geometric shapes. Author: N. Pirovski, 2024.

The scheme according to which the vertebra is built is as follows: behind is the spiny process, forward is its body, on the sides are the transverse processes, and above and below there are articular processes. The initial tendency of the vertebrae above the center is to form well-formed ribs, while those below it- to reduce the size of the ribs. The lumbar vertebrae have only a small process, which is a remnant of the ribs; thoracic have well-developed ribs; In the cervical part the ribs are not noticeable, but the transverse process bifurcates, or rather the rib fuses with the transverse process to form a canal. In the sacral part, the bony tissue of the ribs fuses to form the solid bone of the sacrum. If we have to graphically describe the change in the size of the ribs for all vertebrae, a sinusoidal curve will be obtained (Fig. 3).

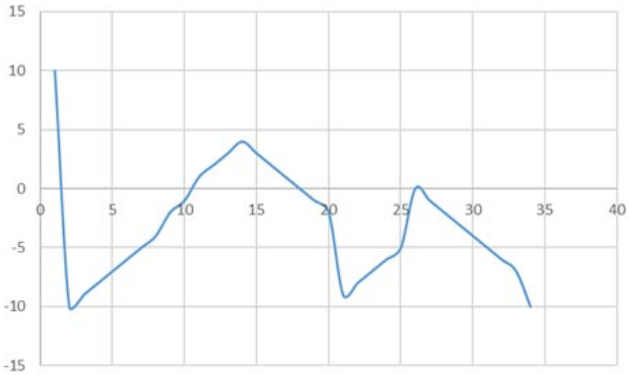

Fig. 3. Size of the derivatives of the ribs in the different segments of the spine. The vertical is the size in cm, and the horizontal is the level relative to the vertebrae. Author: N. Pirovski, 2023.

Embryological data shows that there are rudiments of ribs between all the vertebrae, they are not lost, but only modeled in a different way, see Figure 4.

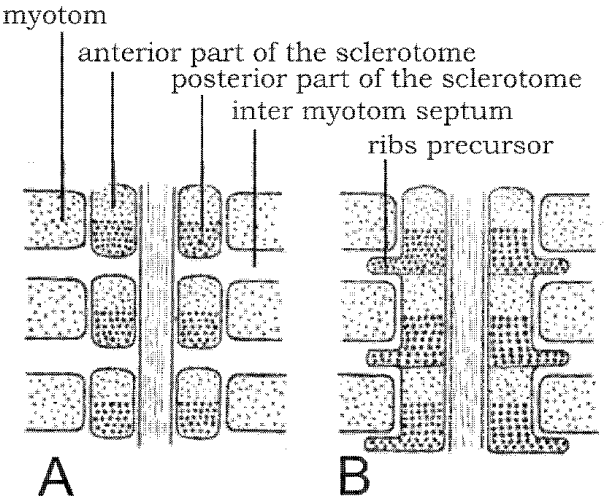

Fig. 4. Rib rudiments. A- initial stage of sclerotome formation, B- rudiments of ribs formed. Author: N. Pirovski, 2024.

The most inconspicuous rudiments of ribs remain in the caudal vertebrae, which are the smallest and poorly developed in general. This tends to be the case in intermediate areas where dominance from one system shifts to another. The bodies of the vertebrae increase in the lower direction and decrease in the upper direction. Vertebral torsion is well differentiated in the articular processes, which are located upward in the anterior-posterior direction, and in the left-right downward direction. There is also a characteristic difference in the shape of the lumen. While it is round in the 10th vertebra, it tends to become oval in the lumbar and upper thoracic vertebrae, becoming triangular in the cervical and sacral, and approaching a sphere in the tail and skull. We see the result of a natural mathematical progression from a point, through a circle and an ellipse to a triangle and a sphere (Fig. 5).

The overall arrangement of the vertebrae forms the vertebral column and the axial skeleton, which gives the body primary shape and support. It also has a spiral structure, distinguishable in four curves - cervical lordosis, thoracic kyphosis, lumbar lordosis, sacral kyphosis. The upper two

are in the opposite (reciprocal) direction to the lower two. We see that the forward and backward curves alternate twice, after which there is a swirl and a reversal of the direction of the spiral, with a transition to another system in the area of the head and pelvic floor. This transformation in the caudal part is more discrete, due to its small size, but reciprocally developed in the upper part with the formation of the brain skull, its passage through the facial skull and its completion with the hyoid bone, where the skeleton passes into the respiratory system through the larynx (the transition is also from bone to cartilage).

Scale is rarely talked about in anatomy, but in the skeletal system it is clearly evident. Moving away from the center, there is a tendentious qualitative change in the way the bones are formed, which gives a difference both in their size, number and classification.

The vertebrae are the first segment (regular bones) of the bones of the skeletal system. The tendency for them to increase in size and to pass from spherical to flat to long is exhausted by the sixth segment, after which the opposite tendency is observed. The rudiments of the ribs are involved in the formation of: The scales of some cranial bones; the transverse processes of the cervical vertebrae; the ribs; the costal processes of the lumbar vertebrae; the body of the sacrum, which are located in scale 2. Scale 3: The principle of symmetry and analogy between the lower and upper part of the body proves the positioning of the sternum and the ilium as analogous and places them in one scale category and the harmonious asymmetry and reciprocity defines them as a fractal system (having non-trivial self-similarity). Scale 4: Clavicle and pubic bone; Scale 5: Scapula and ischium. The shoulder girdle and the pelvic girdle are equidistant from the center of the body, made up of bones in the same scales (3, 4 and 5), with the same number of elements, function and boundaries, but with a modified shape due to the reciprocity of their positioning. Scale 6: This category includes the humerus and femur. This is the final scale to which bones grow in mass and size. In subsequent scales they decrease in mass but increase in number. Both their number and the tendentious change in their structure largely coincide with the pattern of change described in the "Book of Changes" (I Ching) (Pirovski, 2022). The initial division of the body into upper and lower halves continues with the separation of left and right, as well as front and back. Finally, six final parts are formed, 4 limbs, head and tail, which corresponds to the distribution of categories by hexagrams.

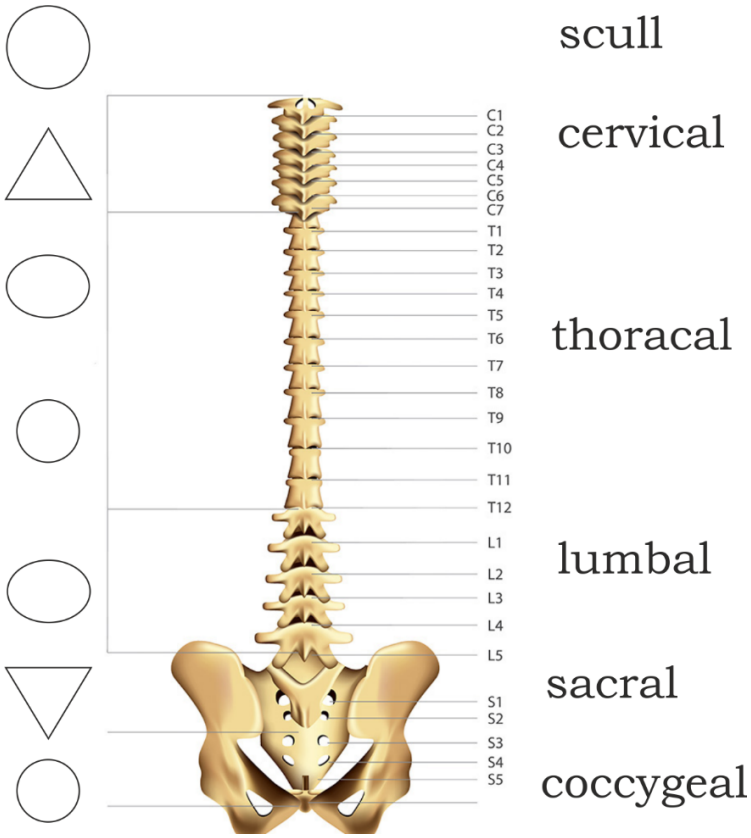

Fig. 5. Transformation of the vertebral opening. Author: N. Pirovski, 2024.

The knee and elbow joints are at the limit of change and there is only one freedom of movement in them - folding and unfolding. For scales from 7th to 12th in the decimal number system, there are no special digits, even though they are different categories. The analogy between the number, type and shape of limb bones is obvious. Scale 7: Tibia, Fibula, Ulna and Radius. The bones in the limbs have a pronounced spiral shape, a consequence of metameric development. The right one has a left-handed helix, while the left has a right-handed one. The lower ones are of opposite rotation, i.e. the left has a left spiral and the right has a right spiral. Scale 8: The inclusion of the patella in the list of foot bones brings their number in the lower limb to 8, so that it is the same as the number of carpal bones in the upper limb. Scale 9: The metacarpals and metatarsals are very similar, forming the arch of the wrist and foot. Arches are direct evidence of the spiral shape of the skeleton and a unique feature of human limbs, allowing them to spring and distinguishing them from the animal world. Scale 10: The proximal phalanges of the limbs are equal in number, assuming that the sesamoid bones of the thumb are the nuclei of ossification of the first proximal phalanx. Then all the fingers have an equal number of bones. Scale 11: Middle phalanges.

Scale 12: Distal phalanges. After arranging the elements of the skeleton in 6 successive scales, a tendency to change the organization with the exhaustion of the centrifugal force is observed, which continues for another 6 scales, after which the bones are exhausted as organs and pass to another system. The distal phalanges are the last material structures of the skeleton in terms of distance from the center of the body. The arch of the foot and the palm form the negative space where walking and manual labor are realized. It is the place of transition between the environment inside the body and the environment outside the body. At these places of transition with vortices shape (such as the roughness of the phalanges and the papillae of the dermis), the body releases products into the environment (the palms and soles are the skin areas with the most abundant sweating and peeling). This is the end of the skeleton and it passes into the next system of fascia and joints. Nails are located at the margin of the skeletal and skin systems (Table I).

Table I. Qualitative scales in the skeleton (Pirovski, 2023).

A skeleton			
scale	element type	number of items	Name
0	Center	1	Center
1	regular bone	16↑+16↓=32	Vertebrae
2	flat bone	32⇐+32→= 64	Rib ↑↑
3	flat bone	2↑+2↓=4	sternum/ilium
4	long bone	2↑+2↓=4	clavicle/pubis
5	flat bone	2↑+2↓=4	scapula/ischium
6	long bone	2↑+2↓=4	humerus/femur
6a	long bone	4↑+4↓=8	ulna and radius/ tibia and fibula
5a	regular bone	16↑+16↓=32	carpal and tarsal bones
4a	long bone	10↑+10↓=20	metacarpal and metatarsals
3a	long bone	10↑+10↓=20	proximal phalanges
2a	long bone	10↑+10↓=20	middle phalanges
1a	regular bone	10↑+10↓=20	distal phalanges

Using the decimal number system has great advantages. However, when we need to describe the human body, it turns out that the 12-point number system, similar to the one used in Sumerian, China, the Mayan civilization and the Bulgarian calendar, is more convenient. Modern civilization also uses it daily, sometimes without even realizing it. It is embedded in the way of counting time, which is measured in 12 months, i.e. two half-years of six months each, as well as in minutes of 60 seconds (5x12).

The skeleton can be grouped into two parts - central and peripheral, according to the distribution of the elements in them, as well as due to the reversal of the trend in their morphology (reciprocity), and as a conclusion from the study of the joints. The parallel with the Book of Changes is interesting, where an analogous arrangement of lines can be observed, matching the elements in the skeleton.

The reciprocity of the upper and lower body is clearly expressed in the middle of the development of the system (shoulder and pelvic girdle), after which the differences decrease and the similarities increase(humerus and femur). Moving away from the center of the body in an upper and lower direction also leads to an expansion of the body, as well as its branching downwards into: right leg, left leg, genitals; and up into: right arm, left arm and head. Thus six terminal modules are formed, each of which unites all systems in the body to produce a specific function. Although they appear to function simultaneously and equally, there is cyclicity in the activity of the left and right halves and also of the modules. An example of this is breathing through the nostrils, in which the two nostrils alternate every 20 minutes, whichever is more active, as well as the normal gait, in which the left and right hand alternate in the leading position.

Macroscopically, the skeleton looks like a figure of two spirals pointing up and down, each branching into three parts turning back. The bones located within them form both centrifugal and centripetal spirals. This information complements the graphical representation of the spiral structure as two upward and downward centrifugal spirals, each branching into three parts (left-handed, right-handed, and transitional-front-/back-spin), exhausting their momentum and changing direction at 180º, describing centripetal spirals of the same shape but opposite direction and ending again at the center of the system, making a closed loop (Fig. 6).

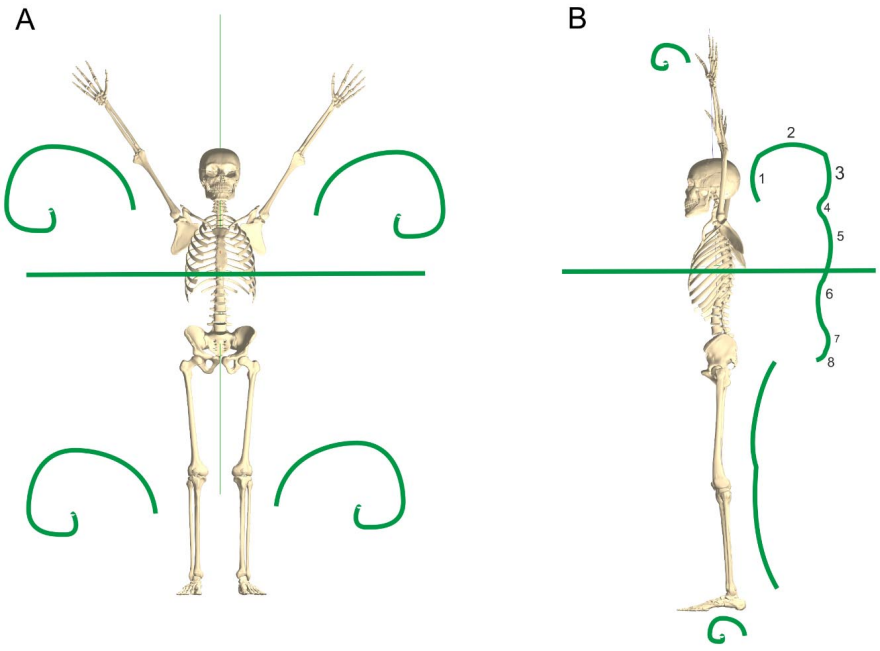

Fig. 6. Spiral curves of the skeleton. A- torsion of the limbs in the horizontal plane, B- Curves of the bones in the frontal plane and arch of the palm and foot. Author: N. Pirovski, 2024.

At the margin where the change in direction takes place, spiral vortices can be seen on the organs and body, such as are seen on the bones of the skull, on the scalp, fingers, tongue, apex of the heart, perineum, uterus, brain, etc. These are also the places where one system passes into another and organs with atypical structure and functions, the so-called intermediate type, can be observed. It is important to note that the skeleton is not a continuous structure, but an alternation of bone and negative space between the bones - joint clefts, which are the propagations of the center in the skeletal system, shaping it as a discrete function. Around these spaces also appear the joints that connect the bones and limit their movements. The negative bone spaces are the positive joint spaces and the negative joint spaces are the positive bone spaces. Only intertwined, in cooperation, can they function.

The development of the skull is so complicated that it reaches an extreme in the development of the bones and they pass into another system. This happens through the bones of the facial skull. The frontal bone is both cerebral and facial, which is an argument for supplementing the classification of the organs with intermediate ones. The temporal passes into the auditory balance apparatus, the sphenoid by forming the orbit into a visual apparatus, the upper jaw to the respiratory system by forming the nasal cavity, the palatine to the digestive system by its participation in the formation of the oral cavity, etc., many examples can be listed. The development of the arches of the soles and palms is also a superior engineering achievement (Mutafov, 1988).

According to the development of the upper jaw, lower jaw and hyoid bone, due to their embryological development, they can also be considered as consistent of six parts. After the hyoid bone, no more bones are found, only cartilaginous structures of the respiratory system. In the jaws, the negative space branches out to a maximum, forming 32 bubbles in which the teeth develop. Teeth are the first organ of the digestive system and are not bones. Systemically speaking - the skeletal system is the softest in the human body, due to the presence of bone marrow in it, in which the reticular collagen fibers are the finest, while the digestive system is the hardest system in the body, due to the presence of such organs in it as are the teeth.

DISCUSSION

There are many articles that explore various aspects of the biomechanics and structural properties of human bones, including their spiral configurations and how these impact their mechanical behavior and resistance to stress and fractures. Some of them concentrate on single bone, or on the principles of building a bone structure (Buss *et al*., 2022). However, other scientists (Peng *et al*., 2020), build a more efficient model based on Graph Convolutional Networks and on a Riemann manifold, defined via the Poincaré geometry. Most of them agree that the twisting occurring on each hierarchical level of bone is directly linked to enhancement of function. A new skeleton detection method that is geometry-aware was proposed, based on neural network framework (Xu *et al*., 2019). Implementation of different types of geometry for movement detection is a constantly search for new algorithms (Wang & Wang, 2018), and could benefit from a better understanding of the spiral shape of the skeleton.

The pathology processes could also be a proof for the spiral structure of the skeleton (Donahue *et al*., 2000; Bouxsein & Karasik, 2006). Predominant use of two-dimensional techniques to assess bone geometry is limiting its proper understanding. The biomechanical properties of the skeleton confirm the spiral structure. The idea develops over time with better understanding of the spiral structure (Roesler, 1987; Nigg & Herzog, 1999). The idea of the spirals in the human skeleton is not new, but we are far from a full understanding of its structure.

CONCLUSIONS

The center of the body is free of bones. The closest bone to it is the vertebra, so it is the standard for a bone and the central organ for the skeletal system. The center of the vertebra is also a negative space known as the vertebral foramen. It changes shape according to the standard model for matter transformation in the physics, from point to sphere and back. The scaling is important for the properties of the organs (bones) in the skeleton.

The position of the clavicula in the spiral of the skeleton is an argument that the normal position of the body is with raised upper limbs.

Once the full development of the skeleton is reached, it transfers to another system in the body. This is why it should be described as a discrete function.

The skeleton has a spiral shape. Spirals could be left and right, in different planes, but at the end of the body they change direction form centripetal to centrifugal.

The spiral shape of the skeleton system changes over time, as it starts to expand during embryology development and shrinks after the age of 35 as it is described in the osteoporosis process. New geometrization of the human body could be beneficial.

The arches of the sole and the hand are unique features for humans, separating them from other animals and facilitating the extraordinary resilience in standing up position and for marathon, and the agility of the hands.

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RESUMEN: La cantidad acumulada de información sobre la morfología humana es enorme y esto conduce a un entorno adecuado para un nuevo salto cualitativo en la comprensión del cuerpo humano. La teoría espiral del cuerpo humano (TEH) ofrece un nuevo enfoque para describir al ser humano, basado en el pensamiento sistemático y la comprensión moderna de la física y la anatomía. El propósito de este informe es validar esta teoría desde la perspectiva del esqueleto humano. El esqueleto humano está ubicado detrás del centro del cuerpo y es la parte más interna del sistema musculoesquelético que expresa claramente cualidades espirales. La mayoría de los axiomas de la TEH podrían ser validados por el esqueleto humano y el aparato locomotor, además de ser una buena demostración antropológica de las características humanas típicas que lo distinguen del mundo animal.

PALABRAS CLAVE: Humano; Esqueleto; Espiral; Teoría; STHB; Huesos.

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