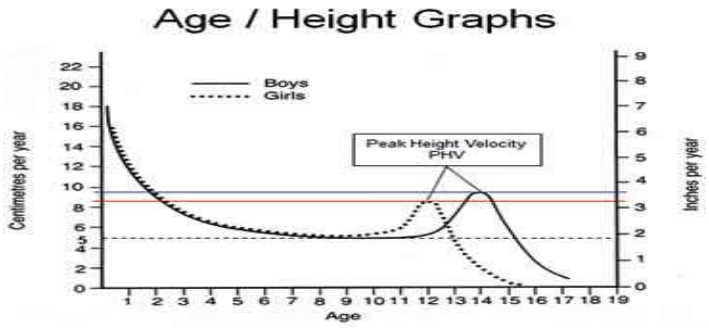
Post-natal period

Postnatal growth is defined as the first 20 years of growth after birth. It is comprised of three periods: infancy, childhood and adolescence.

In Infancy, growth proceeds at a relatively high rate, slowing progressively during childhood to reach a minimum rate in pre-pubertal period. There is an increase in growth rate in puberty and finally a marked slowing in growth rate to maturity.

The age at which these phases of growth begins and ends varies between individuals. Girls attain puberty earlier than boys. Generally, girls precede boys in growth spurt by approximately 2 years. The growth spurt that accompanies puberty can be expected at the age of 10-12 years in girls and 12-14 years in boys. It lasts for 2-2.5 years in both genders.



Growth stops in 18 years in female and 20 years in males.

As the two main component of the head (cranium and face) differ in their relative proportion at birth and at maturity, therefore they must grow at different rates.

Growth rate of the cranium

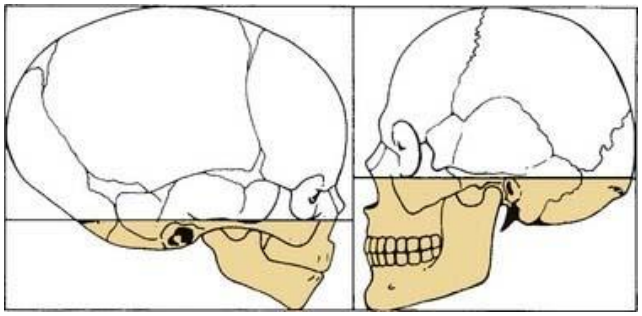
The cranium which has grown rapidly before birth continues to grow rapidly up to about one year of age, accommodating the brain. Thereafter, the growth rate decreases and by about 7 years of age the cranium has reached 90% of its final volume. Then there is a slow increase in size to maturity.

Growth rate of the face

The Growth rate of the face, which is highest at birth, falls sharply and reaches a pre-pubertal minimum level, and then it increases to a peak at puberty, declining again until growth stops in late teenage.

The relative sizes of the face and the cranium at birth and in adult life is noticeably different. The cranium grows rapidly in prenatal period, accommodating the rapidly developing brain.

In contrast, the face appears small in vertical dimension when compared to that of the adult. This is because the bones which contribute to the vertical dimension of the face (nasomaxillary complex and mandible with their alveolar bones), are relatively small at birth. Cranium is more developed at birth than the face and forms a major proportion of the head. There is much more growth of facial than cranial structures postnatally.



Facial growth is normally associated with eruption of the primary dentition between 1 and 3 years of age and of the permanent dentition between 6 and 14 years of age, when the erupting teeth and developing alveolar process add to the total size of the jaws.

Also the mandibular growth continues for about 2 years longer than maxillary growth and this difference in growth between the two jaws may be important in orthodontic treatment planning.

Mechanism of bone growth:

Bone growth is based on certain basic principles. Bones do not enlarge symmetrically, but grow by complex differential mechanisms.

Two mechanisms or concepts are important for bone growth:

- Direct bone growth by means of deposition and resorption (remodeling) processes on the bone surfaces, which cause the cortical plate to drift.
- Displacement of the entire bone occurs due to the growth of the bone itself or expansion of adjacent structures.

Remodeling is the basic growth process providing regional changes in shape, dimensions and proportions of the bone while maintaining the integrity and basic shape of the bone and providing regional adjustment for adapting to the changes in function. If the resorption and deposition takes place at the same rate, thickness of the bone remains constant with only changes in location of the cortical bone. On the other hand, if the bone deposition is more than resorption, thickness of the cortical bone increases along with its movement. For example, the teeth follow the drift of their alveolar bone while the jaw is growing and thus they maintain their position within the surrounding bony structures.

Growth movements

Two kinds of growth movements, cortical drift and displacement are seen. All bones have one common growth principle that is drift.

Drift: is the growth movement (relocation or shifting) of an enlarging portion of a bone by the remodeling action of its osteogenic tissues, occurring towards the depository surface.

Displacement: physical movement of the whole bone. Displacement is a translator movement of the whole bone as a unit caused by the surrounding physical forces. The entire bone is carried away from its articular interfaces (sutures, synchondroses and condyles) with the adjacent bones. Displacement is of two types:

Primary displacement: as the bone enlarges, it is simultaneously carried away from the other bones in direct contact with it. This creates space within which bony enlargement takes place. It is the physical movement of the whole bone, as the bone grows and remodels by resorption and apposition. The amount of anterior displacement is equal to the amount of posterior lengthening.

Secondary displacement: it is the movement of the whole bone caused by the separate enlargement of the other bones, which may be nearby or quite distant. It is the movement of bone related to enlargement of other bones. For example, growth in the middle cranial fossa results in passive movement of the nasomaxillary complex anteriorly and inferiorly.

Theories of bone growth

There are three main theories of bone growth, each of which plays its part in the growth of the skull and jaws:

Cartilaginous theory

The growth of cartilage is by cell division with progressive conversion to bone by ossification. This growth occurs mainly:

A- At the base of the skull (spheno-occipital synchondroses) would increase the antero-posterior dimension of the skull base.
B- In the area of the nasal septum would bring the nose forward from its original position under the front of the cranium.
C- At the head of the mandibular condyle would increase the total length and height of the mandible.

Sutural theory

The sutures are the primary determinants of the craniofacial growth. The craniofacial skeleton enlarges due to the expansion forces exerted by the sutures as they separate.

The primary event in sutural growth is the proliferation of connective tissue between two bones. Proliferation of the sutural connective tissue creates the space for appositional bone growth between the borders of two bones.

The sutures which separate the face from cranium are mainly sagittal aligned so that growth at these sutures would move the face in forward and downward direction in relation to the cranium

Periosteal and endosteal theory

The apposition of bone on the periosteal surface would enlarge the head in all dimensions, but this will increase the thickness of bone therefore concomitant resorption of bone is necessary in order to obtain the appropriate thickness and strength.

It is generally thought that this method is the most active type of growth in the skull and jaws after the first few years of life when cartilaginous and sutural growth slows.

Moss theory (functional matrix theory):

This theory depends on the concept "form follow function" that each part of the skull will grow by the stimulation of the tissue matrix, that mean the bones will grow to accommodate a growing vital organ as:

- The vault of the cranium will grow by the stimulation of the growing brain
- The orbital cavity will grow by the stimulation of the growing eyeballs.
- The growth of the mandible can also be stimulated by the growth of the tongue.
- The alveolar bone growth can also be stimulated by the development and eruption of teeth.

Functional matrix theory states that "**the expansion of the soft tissue matrix is primary and the bone growth is purely a secondary and compensatory**".