In the name of GOD
Postnatal Facial Growth and Development

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Reference:

Contemporary Orthodontics
Chapter 2

Introduction
Pattern

- reflects proportionality
- usually a complex set of proportions
- growth pattern represent the change in proportional relationships over time
- an important aspect is its predictability
Cephalocaudal gradient of growth
Within the head and face, the cephalocaudal growth pattern strongly affects proportions.
Scammon’s curves

*Not* all the tissue systems of the body grow at the same rate.

The *overall* pattern of growth is a reflection of the growth of the various tissues.
Variability

everyone is not alike in the way that they grow. It can be difficult, but clinically very important, to decide whether an individual is merely at the extreme of the normal variation or falls outside the normal range.
Normal variability is derived from large-scale studies of group of children.
These charts can be used in two ways:

• the location of an individual relative to the group can be established

• growth charts can be used to follow a child over time to evaluate any unexpected change in growth pattern
Variability arises in several ways:

• *normal* variation
• influences *outside the normal* experience (e.g. serious illness)
• *timing*
Timing

The **same event** happens for different individuals at **different times**, and the biologic clock of different individuals are set differently.

Timing variability can be reduced by using **developmental age** rather than chronologic age.
Chronological age Vs Developmental age
Skeletal age
Skeletal age
Dental age
Methods for studying physical growth
Craniometry

- the first of the measurement approaches
- based on measurement of skulls found among human skeletal remains
- precise measurements can be made on dry skulls
- all the growth data must be cross-sectional
Anthropometry

• it is possible to measure skeletal dimensions on living individuals
• by using soft tissue points overlying the bony landmarks
• the measurement results affect by soft tissue thickness
• makes it possible to follow the growth of an individual directly (longitudinal data)
Cephalometric radiology

- It is considerably important not only in the study of growth but also in clinical evaluation of orthodontic patients.
- The technique depends on precisely oriented the head and control of magnification.
- It allows to follow direct measurements of bony skeleton over time (superimposition).
- It produces two-dimensional representation of a three-dimensional structure.
Three-dimensional imaging

- allows 3-D reconstruction of the cranium and face
- **CBCT** significantly *reducing* the radiation dose
- *superimposition* is much more *difficult* than 2-D cephalometric radiographs
- **MRI** can be used for 3-D imaging with no radiation exposure
Vital staining

Dyes that stain mineralizing tissues (or occasionally soft tissues) are **injected** into an animal.

Dyes remain in the bones and teeth and can be detected later after **sacrifice** of the animal:

*sites of active skeletal growth at the time of injection*
Alizarin reacts strongly with calcium.
**Tetracycline**

An excellent vital stain

Binds to calcium at growth sites
Radioactive tracers

any radioactively labeled metabolite becomes incorporated into the tissues as a sort of vital stain

Tc 99, C-proline, 3H-thymidine
Implant radiography

Inert metal pins are placed in bones

Considerable increase in the accuracy of a longitudinal cephalometric analysis of growth pattern
Data analysis

- cross-sectional
  - much easier and quicker
  - variability within the sample can conceal details of the growth pattern

- longitudinal
  - great deal of information can be gained from a small number of subjects
  - highlight individual variations particularly timing effects
Velocity curve vs. Distance curve

Velocity curve showing not total length but the increment added each time interval

Changes in the rate of growth are much more easily seen in the velocity curve
Facial growth and development

II: Postnatal
Cranial vault

The bones that cover the upper and outer surface of brain
Cranial vault

- number of flat bones that are formed directly by intramembranous bone formation
- the growth process is entirely the result of periosteal activity at bone surfaces

- remodeling and growth primarily occur at the cranial sutures
• periosteal activity changes both the inner and outer surfaces of bones

• the fontanelles allow a considerable deformation of the skull at birth

• after birth, bone apposition along the edges of fontanelles eliminates these spaces
• the bones remain separated by a thin, peristeme-lined suture for many years

• apposition of new bone at sutures is the major mechanism for cranial vault growth

• remodeling of the inner (resorption) and outer (apposition) surfaces, allow for changes in contour during growth
Cranial base

The bony floor under the brain,

Which also is the dividing line between the cranium and the face
Cranial base

• the bones of the base are formed by endochondral bone formation

• this is particularly true of the midline sutures

• as ossification proceeds, bands of cartilage called synchondroses remain between the centers of ossification
• histologically a synchondroses looks like a two sided epiphyseal plate

• the cranial base is rather like a single long bone with multiple epiphyseal plate-like synchondroses.
Spheno-occipital synchondroses

Intersphenoid synchondroses

Spheno-ethmoidal synchondroses
to be continued ...