Functional Development

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Functional Development

Definition of Development:-

"It is progress towards maturity

"given by "TODD".

Acc. To MOYERS,

Development refers to all the naturally occurring unidirectional changes in the life of an individual from its existence as a single cell to its elaboration as a multifunctional unit terminating in death.

Objectives of studying functional development

I. to relate the function to the morphology of the craniofacial complex.
II. to apply the theories of craniofacial growth and biomechanics to better understand the morphology, ontogeny and phylogeny of the craniofacial complex
III. to provide the scientific basis for the clinical applications in the treatment of craniofacial anomalies.

- It is accepted that the form and function are interrelated.
- Form follows function.

Form (Structure) and Function

Form (structure) follows Function.

Function determines form (structure).

Function controls form (structure).

Function regulates form (structure).

Form (structure) is the realization of information and the product of the functional attributes.

Functional Matrix Hypothesis (*Moss' Hypothesis*)

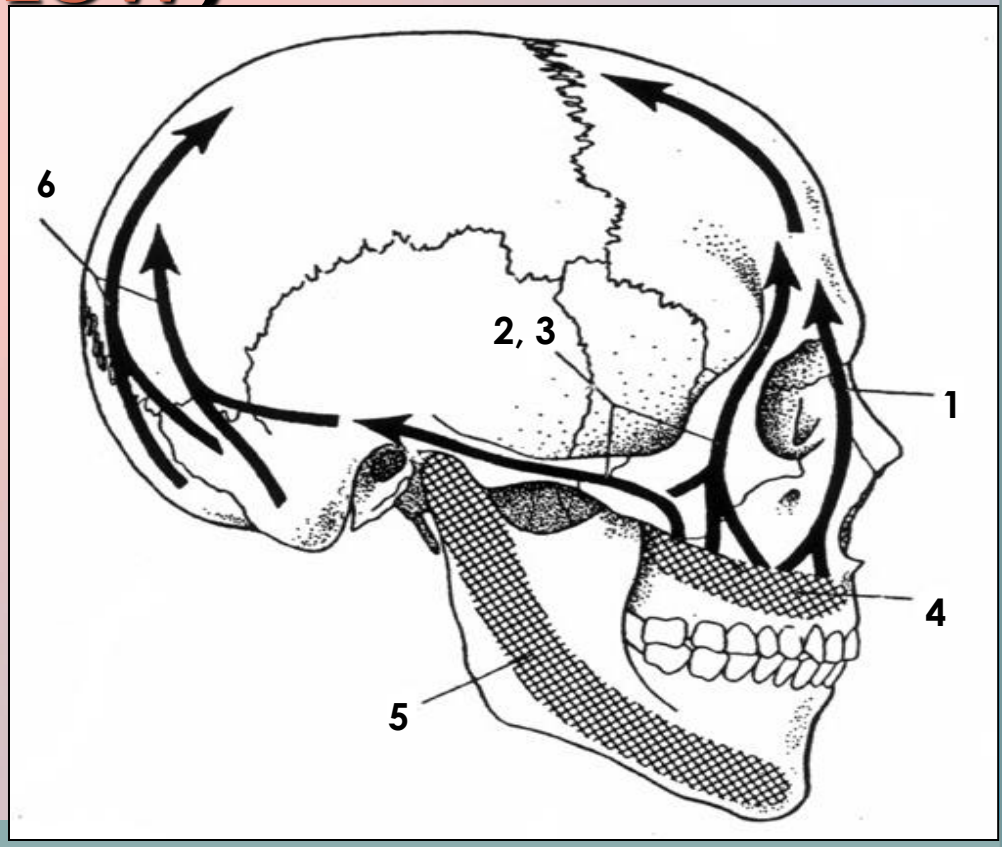
"The origin, development and maintenance of all skeletal units are secondary, compensatory and mechanically obligatory responses to temporally and operationally prior demands of related functional matrices."

Functional Structure of Skull

(From a mechanical point of view)

In the force loading areas, pillar-like struts serve as mechanically efficient reinforcements to resist and dissipate pressure and traction, especially to the masticatory force.

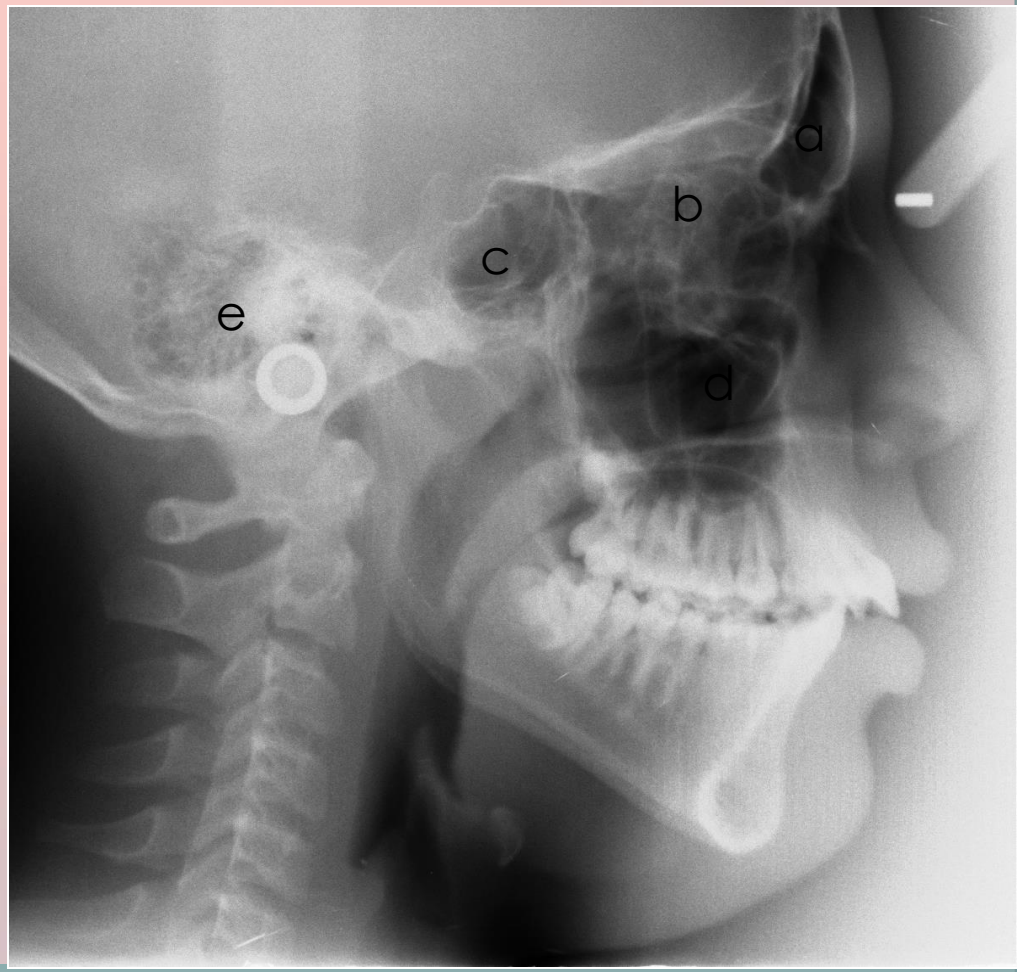
1) Fronto-nasal pillar
2) Zygomatic arch pillar with vertical branch
3) Zygomatic arch pillar with horizontal branch
4) Basal arch in upper jaw
5) Basal arch in lower jaw
6) Occipital pillar
7) Pterygoid-palate pillars



Functional Structure of Skull (From a mechanical point of view)

- In the non- or less force loading areas, adipose tissue and pneumatic cavities fill those mechanically neutral areas.

1) Paranasal sinuses
   a) Frontal sinus
   b) Ethmoid sinus
   c) Sphenoid sinus
   d) Maxillary sinus
2) Accessory tympanic spaces
   e) Mastoid air cells



- **Head (craniofacial complex) is a region, where a series of functions are carried out.**
- **These functions include *vision*, *hearing*, *speech*, *mastication*, *swallowing* & *digestion*, *respiration*, *neural integration*, and others.**

Mastication:-

- A complex activity.
- Aim : Breaking down and insalivations of food preparatory to swallowing.

In Infants:-

- mastication in true sense is not present.
- The food is taken in by sucking as the diet is in liquid form.

In Adults

6 phases of mastication given by Murphy

a) Preparatory Phase
b) Food contact
c) Crushing Phase
d) Tooth contact
e) Guiding phase
f) Centric occlusion

a. Preparatory Phase

Includes

Positioning of ingested food by the tongue towards the chewing side and

mandibular movement to the same side

b. Food contact

Includes

Evaluation of viscosity of ingested food characterized by

momentary pause.

c. Crushing Phase

Crushing of the ingested food starts with high velocity and gradually slows down.

Above factors will have marked effect upon the nature of ultimate occlusion.

d. Tooth Contact

Teeth come in contact

Signifies

The end of crushing phase.

e. Guiding Phase

Teeth contact becomes unilateral and food is guided for deglutition.

f. Centric occlusion

Teeth come to centric occlusion.

Deglutition

Carried out by stomatognathic system

Different in infants and adults.

Infantile Swallow

During process of sucking the nipple is drawn into the mouth by negative pressure from within.

The tongue lies over the lower gum pads and protrudes between the nipple and lower lip.

The milk is directed to the pharynx by an automatic peristaltic movement of the tongue and mylonyoid muscle.

The milk passes between the faucial pillars and the lateral channels of the pharynx.

Any excess milk dribbles down the chin.

Regular breathing continues during this process.

Characteristics of infantile swallow

- The jaws are apart and the tongue in placed between the upper and lower gum pad
- Mandible in stabilized by the contraction of the muscles innervated by 7^{th} cranial nerve
- The swallow is guided and to large extent controlled by sensory interchange between the lips and tongue.

Mature swallow

- Seen after a year of life
- Infantile swallow gradually disappears with the eruption of the buccal teeth primary dentition

- 4 phases are seen during mature swallow

a. The preparatory swallow
b. Oral phase
c. The pharyngeal phase
d. The esophageal phase

a. # The preparatory swallow

The food is assembled as a compact bolus on the dorsum of the tongue

To achieve this the teeth are parted a little and the cheeck muscle contract

The teeth are then brought in to occlusion to stabilize the jaws and to close the oral cavity properly to isolate it from the labial vestibule

The posterior aspect of the tongue presses against the soft palate to isolate the oval cavity from the pharynx

Thus the oral cavity forms a sealed unit.

b. # Oral phase

Soft palate is raised to seal off the nasal cavity and

Posterior part of the tongue drops down

creation of the smooth path for the bolus as it is pushed into the pharynx by the peristaltic action of the tongue

c. The pharyngeal phase

This phase begins as soon as the food passes through the faucial pillars as the food reaches the pharyngeal walls

reflex upward movement of the entire pharyngeal complex

When the pharyngeal walls touch the soft palate

peristaltic movement sets up to move the food down

d. The esophageal phase

This phase commences as soon as the food passes the cricopharyngeal sphincter

Peristaltic activity of the esophageal walls occur to pass the food into the stomach

The tongue and the palate return to their original position to start the next cycle.

Respiration

Normal development of the orofacial region is to a large extent dependent upon presence of normal respiration

It is an inherent reflex activity

The new born infant is basically a nasal breather.

But in patients having partial or total nasal obstruction

Nasal breathing may not be possible

The alteration in breathing pattern brings about a lowered mandible and tongue position

loss of oro-facial muscular balance

Abnormal development of dental arches

Abnormal development of dental arches can cause

i. Long & narrow face
ii. Narrow nose and nasal passage
iii. Short & flaccid upper lip
iv. Contracted upper arch leading to posterior cross bite
v. Flaring of incisors
vi. Anterior open bite

Speech

learned activity

large no of muscles are involved in production of speech

e.g.:-muscles of the wall of torso

respiratory tract

Pharynx

Soft palate

Lips and face

But speech does not make gross demands on perioral musculature and hence speech defects are rarely a cause for malocclusion

Passive muscle function

A no. of muscles exert force on the developing jaws

Strong interdependence between the bone and the muscles

The integrity of the dental arches and the relationship of the teeth with each other and with teeth of opposing arch is influenced by muscles

because

the teeth and supporting structures are blanketed from all direction by muscles

The dentition on buccal aspect is covered by continuous muscle band

and

opposing buccinators mech. from with in is a very powerful muscular organ, ”The Tongue”

There is constant balance of forces between these and muscles

that

influences the position and stability of dentoalveolar complex.