



NEET - MDS

MASTERS OF DENTAL SURGERY

BY NBE

NATIONAL ELIGIBILITY CUM
ENTRANCE TEST

Volume - 6

Orthodontics & Periodontology



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Why is Growth :- Prevalent
malocclusion so ~~present~~ ?

BUTLER'S field Theory :- Butler divided
mammalian dentition into developmental fields.

e.g. Incisor field canine ~~area~~ field PM-Molar field.

Fields \Rightarrow Distal most part \rightarrow maximum variation. In development.
mesial most part \rightarrow minimum variation.

e.g. lateral incisor show more variability
as compare to C.I.

Size of teeth \rightarrow Fed.
Size of jaw \rightarrow Fed.

Evolutionary changes :- (1) \downarrow In teeth size

(2) \downarrow In jaw size

(3) \downarrow In NO. of teeth

(4) Underdeveloped jaw \rightarrow soft diet.

* All these ~~are~~ contribute to \uparrow In malocclusion prevalence.

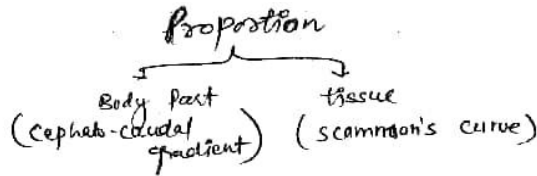
BASIC TENETS OF GROWTH :-
(criteria)

① Pattern :- It indicates the proportion + predictability of growth.

Variability & Proportion of body parts ^{can be} explained by the \Rightarrow cephalo-caudal
gradient.

Time & seq. (cephalic part grows first, caudal grow later.)

↑ Axis of growth head to toe.

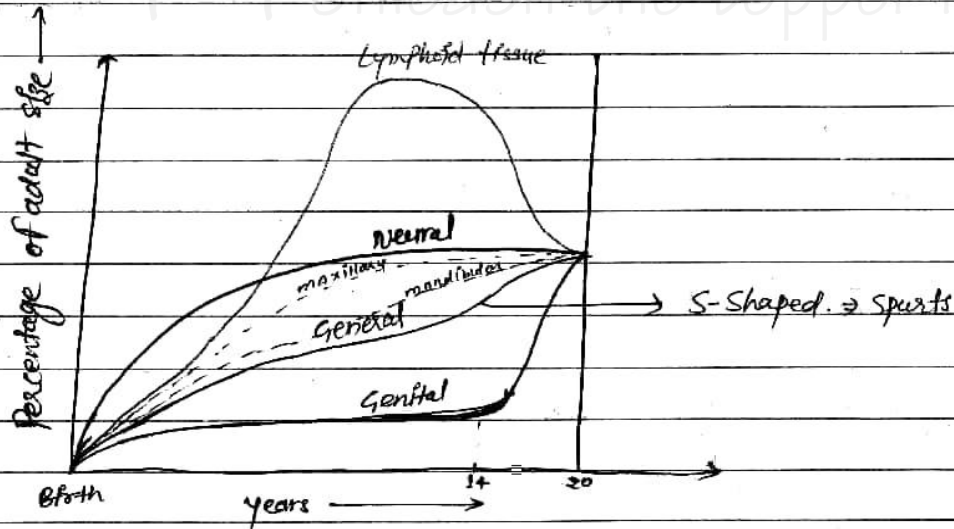


	Head	Lower limb
3rd month (JUL)	50% (Cranium larger than face)	Rudimentary ↑
<u>Birth</u> *	39%	1/3rd ↑
Adults	12%	1/2 ↑

Maxilla being closer to skull, grows earlier than mandible.

* orthopaedic appliance to correct maxillary deficiency should be given at younger age as compare to mandibular appliances

Scammon's growth curve



∴ Scammon's G.C. → divide tissue into 4 parts.

- (1) Neural tissue completes growth 90% ⇒ 6 years *
95% ⇒ 10 yrs.
- (2) Lymphoid tissue ⇒ 100% ⇒ 7 yrs
200% ⇒ 14 yrs.

Lymphoid tissue

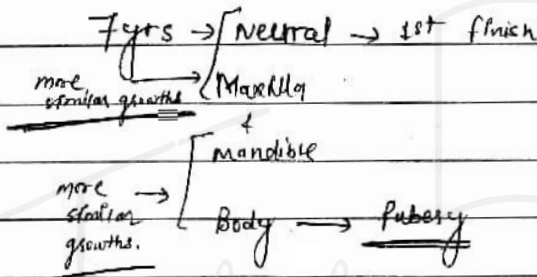
→ Involute (reduced in size) at puberty.

(3) genital → begins at Puberty.

(4) ~~Somatic~~ Somatic → S-shaped pattern with ↑ growth at spurts.

* Growth of jaws falls ⁱⁿ b/w Neural & ^{general tissue} ~~general~~ Curves :-

* growth of maxilla follows the growth of Neural curve more & growth of mandible follow general curve more.



Growth : ↑ in size. ———> +ve phase (Some organs reduce in size)
Development : ↑ in maturation. ———> -ve phase

Development : ↑ in maturation.

↳ always +ve.

differentiation :- change of undifferentiated mesenchymal cells in to specific fun. cell.

② Variability :- It differential Normal & Abnormal growths.

* A child falling beyond the 97th ^{percentile} leads to be studied further to check growth status is abnormal.
 (Bell shaped curve 3% 97%)

③ Timing :- growth spurts.

Name of spurts	female	male
1) Infantile/childhood growth spurts	3yr	3yr
2) mixed dentition/Juvenile growth spurts	6-7 yrs	7-9 yrs
3) prepubertal/adolescent growth spurt.	11-12 yrs	14-15 yrs

Maximum rate of growth is seen from birth to 1 year of life. Some authors believe that the 1st growth spurt occur b/w birth to 1 year of life.

∴ Methods of Studying physical growth:

- (1) Measurement Approaches.
- (2) Experimental ——— " ———.

Measurement

- Craniometry
- Anthropometry
- Cephalometric

Radiology

- Three-dimensional Imaging.

Experimental

- Vital Staining
- Implant Radiography

CRANIOMETRY → measurements of ~~human~~ SKULLS Human
 Cranium measurement skeletal remains.

* Data is precise, but only cross-sectional.

Anthropometry ∴ measuring skeletal dimensions on living ^{Human} individual using soft tissue landmarks.

Cephalometric Radiology ∴ measurement of skeletal dimensions on Cephalometric Radiographs.

3-D Imaging ∴ It has several advantages

- less radiation exposure & more accurate data.

Vital Staining ∴ Invented by John Hunter ∴ Study of pattern of stained mineralized tissues.

using dyes ∴ Alizarin, Te99 & Tetracycline.

- (most commonly done in animals.)

Implant Radiography: BJORK: Insertion of inert metal pins to provide stable landmark for growth measurement.

↳ used along with serial cephalometric radiographs.

Sites for Implant :

(b/w lower central incisors)

Mandible : (1) Symphysis in the midline below roots.

(2) Right side body of mandible one below 1st PM.
and second below 1st M.

(3) outer surface of ramus on the right side in level with occlusal plane.

Maxilla & hard palate → one behind the canine
→ one medial to behind the molar at the
junction of alveolar process & palate.

→ one on each side below nasal spine.

→ one on each side below in the zygomatic process.

:- TERMINOLOGY Related to growth :-

Bone growth

:- Endochondral Bone growth :-

:- Intramembranous Bone growth

Endochondral ossification: Conversion of hyaline cartilage in bone.

→ 3-D in Nature

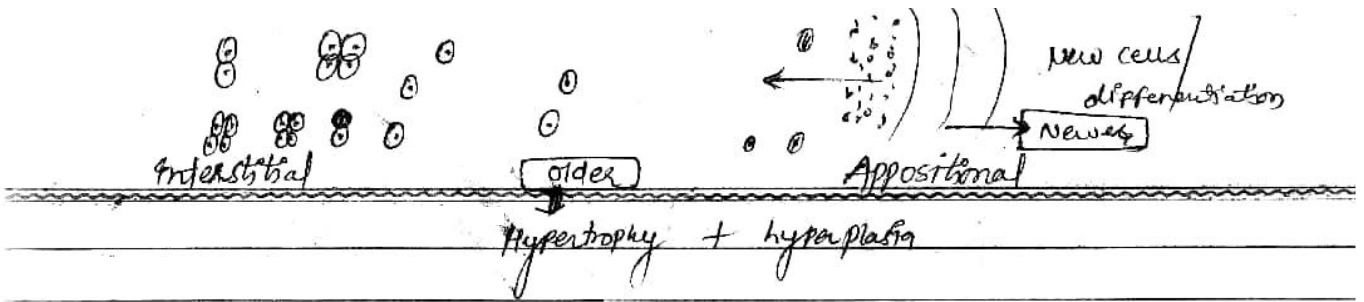
→ slow & indirect process.

Interstitial growth ⇒ soft tissue & uncalcified cartilage.

→ cause by hypertrophy & hyperplasia of existing cells.

Apposition & layered bone form → ↑ in width of the cartilage.

→ Caused by newly differentiated cells.



Intramembranous ossification: Conversion of connective tissue into osseous tissue in the form of sheets.

→ Direct + fast bone growth. =====

Primary & Secondary cartilages

1° - Primary: Present since the beginning.

→ they are derivatives of primordial cartilage.

* Cells arrangement is regular + organised

e.g. ~~epiphy~~ Epiphyseal plate of long bones. ←←←←
→ Spheno-occipital synchondroses.

2° Cartilage: formed later under influence of muscle + bone.
- Haphazard cellular arrangement.

e.g. Coronoid
Condylar

growth fields: areas of bone surrounded by blanket of soft tissue. Responsible for bone growth.

Growth sites: areas of bone that grow more actively, as compared to surrounding.

Growth centers?

these are specialized sites, which have overall control of bone growth. they have intrinsic growth potential.

growth centre	growth site
→ Independent growth occurs	→ max. ^m growth occurs
→ NOT influenced by environmental factors.	→ Influenced
→ Transplantation-inherent growth potential	→ Not Inherent.
→ All growth centers are growth sites.	

1° Growth Movements :-

These provide space for growth of bone.

(1) Cortical drift :- This is produced by simultaneous apposition (deposition) + Resorption on opposing surfaces.
→ movement is towards surface of deposition.

Displacement :- is the movement of the whole as a unit.

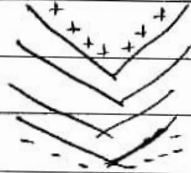
1° displacement :- is produced by the bone's own growth also known as translation.

2° displacement :- is produced by growth of surrounding bones.

* Drift may occur in similar + opposite direction as displacement.

Expanding V-principle :- ENLOW

* Many of the cranio-facial bones are arranged in a V-shaped fashion with growth bone moves towards the wider end of the V. and hence, it expands.



→ also there is deposition on inner side + Resorption on outer side of the V.

e.g. Ramus of mandible, Palate, Coronoid & Condylar process etc.

Enlow's Counterpart principle :-

* growth of any facial & cranial part is related to another counterpart.

• Balance b/w growth of part + counterpart is important

Part	Counterpart
palate	Ant. Cranial fossa
middle cranial fossa	Ramus of the mandible
maxillary arch	mandibular arch
maxillary tuberosity	lingual tuberosity
Bony maxilla	Corpus of the mandible.

Theories of Bone growth :-
(Brash)

① Remodeling theory :- All Cranio-facial growth occurs by selective Resorption & deposition of bone.

② Genetic control theory :- Brook.

* Control of skull growth is mainly by intrinsic genetic factors.

both are general theories. } not talk about Cranio-facial region.

(3) SPICHER'S SUTURAL Dominance theory :- "Stcher & Wehrmann"

- * Most of the Cranio-facial growth occurs at the sutures.
- * Cranial vault & midface regions grow by sutural mechanism.

(4) Cartilage Directed growth theory :- "James & Scott"

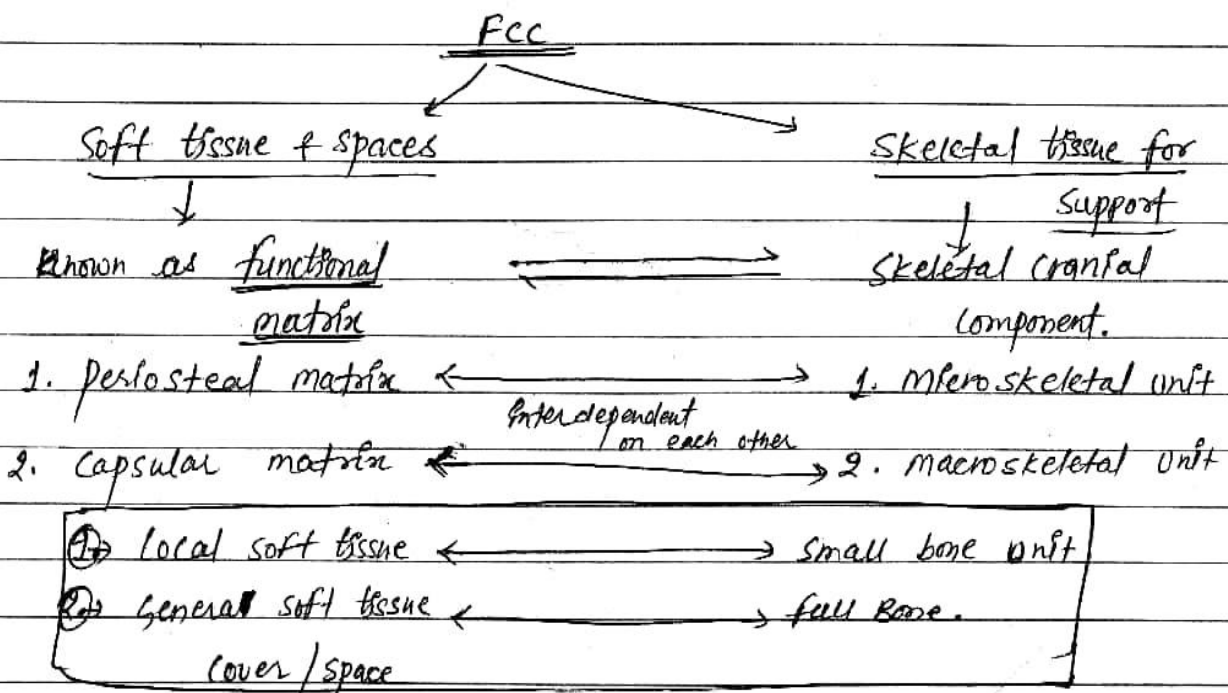
- * Scott proposed that Indisite growth controlling factors are ~~ent~~ in cartilage & in the periosteum.
- * the Nasal septal cartilage is responsible for growth of midface.
- * mandible is long bone, bent in a U-shaped fashion with one end of epiphyseal cartilage on each side.

(5) :- function Matrix theory (Melvin Moss)

(from function correlation)

→ Based on concept of functional Cranial Component (fcc)
↳ given by van der Klaauw.

fcc ⇒ is sum total of all the parts required for single function.
(soft & hard tissue)



Periosteal matrix :- 1) Present in the immediate local environment.

2) Aids directly to change the size / shape of bone.
AK/A → transformation.

3) e.g. Temporalis → coronoid
(Matrix) (Skeletal unit)

masseter → Angle (gonial)

teeth → Alveolar bone.

Capsular matrix :- Complete soft tissue surrounding a bone.
→ Causes Protract change by expansion.

E.g. Neurocranial capsule
oro-facial capsule

FM Hypothesis - Revisited I :- (FMHR₁)

Mechano-transduction is a process of cell signal transfer.
when it happen in bone called as osseous-mechano-transduction

(FMHR₂)

All the bone cells except osteoclasts are connected by Gap junctions forming an osseous connected cellular network (CCN).

(FMHR₃) / Genomic hypothesis.

→ explained role of Genetics.

(FMHR₄)

explained the role of epigenetics & environment. In the form ontogenetic antithesis and resolving synthesis.

(genetic factors outside the skeleton)

Consider 3 main pts: ① Steiner's
② Scott's
③ Moss's.

VAN Limbogh's compromise theory :-

Controlling factors for growth :-

1. Intrinsic Genetic factors: genetic control of the skeletal unit.
2. Local epigenetic factors: genetic influences of surrounding structures.
3. General epigenetic factors: genetic influences of distant structures
e.g. (growth hormone & sex hormones.)
4. Local environmental factors: local non-genetic influences from the external environment. e.g. (muscle force, habits.)
5. General environmental factors: General non-genetic factors from external environment. e.g. (Nutritional status, oxygen supply)

Miscellaneous :-

Speech sound	Problem	Related malocclusion
1) <u>s, z</u> , (Sibilants)	Ups	(Aob) Ant. open bite, spacing.
2) <u>f, v</u> (labiodental fricatives)	Distortion	Skeletal class III
3) <u>t, d</u> (lingual alveolar)	Difficulty in production	Crowding, linguallly placed incisors.
4) <u>Th, sh, ch</u> (linguo-dental fricatives)	Distortion	Aob (Ant. open bite)

Stages of Puberty :-

Girls :- Total duration of adolescent growth :- $3\frac{1}{2}$ years.

Stage 1

Beginning of adolescent growth :- Appearance of breast buds, initial pubic hairs.

Stage 2 (about 12 months later)

Peak velocity in height :- Noticeable breast development, axillary hairs, darker/more abundant pubic hairs.

Stage 3 (12-18 months later)

Growth spurt ending* :- menses, broadening of hips with adult fat distribution, breasts completed.

Boys :- Total duration of adolescent growth 5 years.

Stage 1 :-

Beginning of adolescent growth :- 'fat spurt' weight gain, feminine fat distribution.

Stage 2 :- (about 12 months later)

Height spurt beginning :- Redistribution/Reduction in fat, pubic hair, growth of penis.

Stage 3 :- (8-12 months later)

* peak velocity in height :- facial hair appears on upper lip only, axillary hairs, muscular growth with harder/more angular body form.

Stage 4 :- (15-24 months later) :-

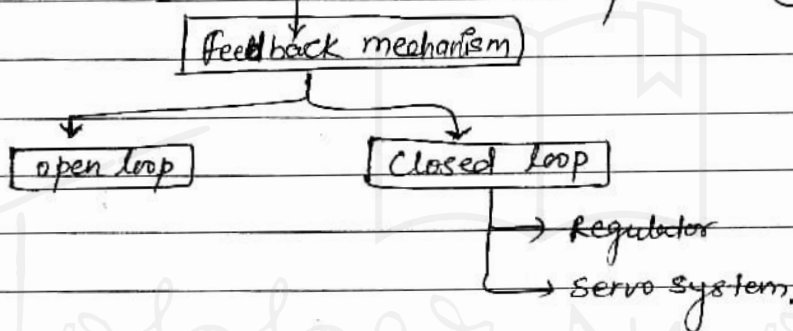
Growth spurt ending :- facial hair on chin & lip, adult distribution of color of pubic & axillary hair, adult body form.

∴ SERVO-system theory :-
was given by Petrovic, Charles & Stutzman.

* Based on concept of Cybernetics.

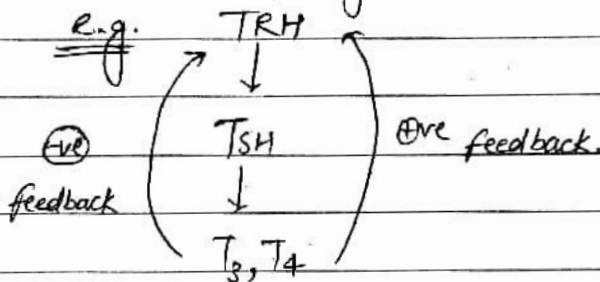
Cybernetics :- operates via signal transmission, It explains the mechanism of control + communication in machine.

* Cybernetics divided into two types → Based on the presence @ absence of feedback mechanism.



* In open loop system, there is no feedback mechanism.

* In closed loop system, a feedback mechanism is ~~out~~.



→ closed loop system divided into two types,

* Regulator system in which input is constant across time.

* Servo-system is also called as follow-up system.

In which input is varies with time, this helps to body to adjust to minor disturbances.

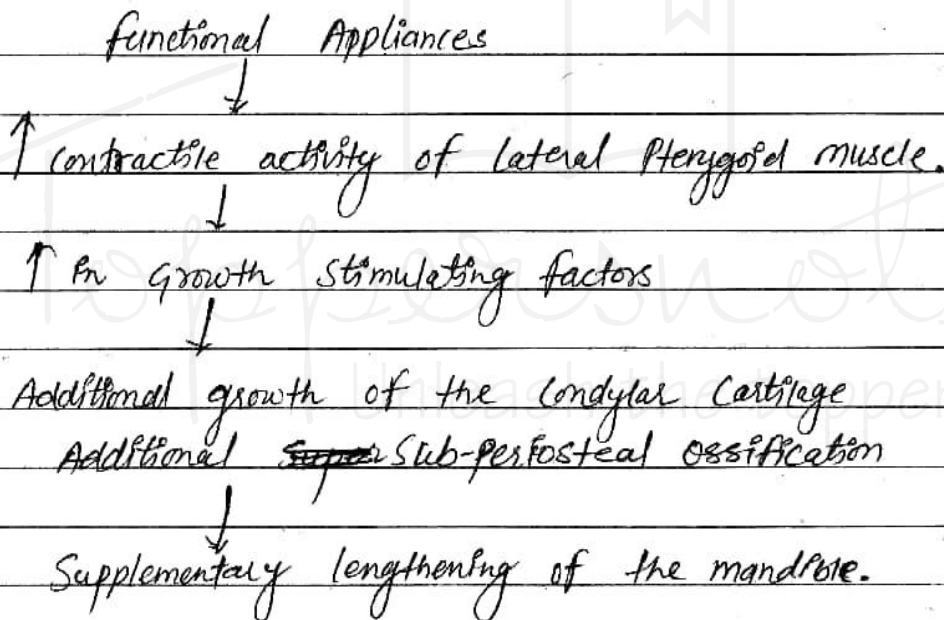
* Servo-system theory also explain the functioning + mechanism of myo-functional appliances.

* The here input is considered as appliances, where as the output is the correction of the malocclusion.

* All the variable factors that within the body, that contributes towards the final growth. @ the unknown factors are indicated by a black box.

→ These can include genetic & epigenetic factors, position of the jaw bones etc...

* Application of servo-system in clinical orthodontics :-



∴ Modern Composite theory :-

→ tries to explain the growth ~~into part~~ & divides the skull into various units, the (a) Structural units are as follows:- calvarium / vault forms the dermocranium.

→ (b) Cranial base & top part of mid face forms the condrocranium.
And rest of the face form the viscerocranium. / splanocranium.

(b) * the functional components of face include (1) neurocranium
(protects the brain)

formed of Vault + Base.

(2) ~~Base~~ face

(3) masticatory apparatus.

∴ Growth Relativity hypothesis (Voudouris)

* Growth relative to displaced condyles from actively relocating fossae.

G.R. Hypothesis
Displacement
viscoelasticity
Referred force.

∴ Prenatal + Post Natal Growth :-

<u>V.N Imp</u>		
<u>Stages of Embryonic cranio-facial development</u>		
Stage	Time (Post-fertilization)	Related Syndromes
1. Germ layer form & initial organisation of structures	<u>DAY 17</u>	FAS (fetal alcohol Syndrome)
2. Neural tube form	Day 18-23	Anencephaly.
3. origin, migration and interaction of cell populations	Day 19-28	Henri-facial microsomia mandibulofacial dysostosis (Treacher's-collins syndrome) Limb abnormalities.
form of organ systems.		
(1) Primary palate	Day 28-38	Cleft lip/palate, other facial clefts.
(2) Secondary palate	Day 42-55	Cleft palate
(3) final differentiation of tissues.	Day 50-birth	Achondroplasia Synostosis Syndromes (Crouzon's, Apert's etc--)