SOP on Age Estimation of living for Medico-Legal Purposes

Department of Forensic Medicine

Faculty of Medicine

UWUSL

Standard Operating Procedure (SOP)
Age Estimation of living for Medico-Legal Purposes

(1) Title
Age Estimation of living for Medico-Legal Purposes

(2) Issued by
Department of Forensic Medicine, Faculty of Medicine, Uva Wellassa University of Sri Lanka

(3) Purpose
To provide a systematic and standardized approach to the estimation of biological age for medico-legal purposes when the chronological age of an individual is uncertain, disputed or undocumented.

(4) Scope
This SOP applies to medical practitioners and relevant forensic personnel involved in medico-legal age assessment of living individuals or unidentified persons where age estimation is required.

(5) Principle
Age estimation is based on the assessment of biological markers that change with age.

Age estimation is an approximation

No single physical or radiological finding can usually establish the exact chronological age. Therefore, age estimation should preferably use **multiple independent parameters**, and the final opinion should acknowledge the inherent uncertainty and limitations of the methods used.

- **a.** < 25 yrs: comparatively more accurate, particularly using **teeth and skeletal development.**
- **b.** > 25 yrs: accuracy decreases considerably; so **multiple parameters** should be assessed together.

(6) Indications
Age estimation may be required in situations such as:

1. Uncertain or disputed age
2. Lack of reliable birth documentation
3. Medico-legal investigations
4. Identification of unknown persons
5. Immigration or legal proceedings where permitted

6. Other circumstances specifically authorized by law

(7) Main Methods

Method	**Important parameters**
General physical examination	Height, weight, body development, secondary sexual characteristics, hair, breasts, greying
Dental examination	Eruption and development of deciduous/ permanent teeth, root formation, Adult dental changes (Gustafson's method)
Radiological examination	Appearance and fusion of ossification centers Epiphyseal fusion, hand and wrist, elbow, clavicle, skull sutures, sternum, sacrum,
Other evidences	Birth records, school records, documents, etc.

(8) ML investigation Procedure -

Can come to the JMO office of the THB on any working day from 8.30-10.30am and take the information sheet of the age assessment.

අනුමාන වයස් සහතිකයක් ලබා ගැනීමට පැමිණෙන ඔබ විසින් රැගෙන ආයුතු ලිපි ලේඛන

01. ඉල්ලුම්කරු අයත් ප්‍රාදේශිය ලේකම් කාර්යාලයෙන් ප්‍රාදේශිය ලේකම් විසින් අනුමාන වයස් සහතිකයක් ලබාදෙන ලෙස අධිකරණ වෛද්‍ය නිලධාරි වෙත නිකුත් කරල ලද ලිපිය

02. ඉල්ලුම්කරු පදිංචි වසමේ ග්‍රාම නිලධාරි විසින් චරිතය හා පදිංචිය පිලිබඳ නිකුත් කරනු ලබන ග්‍රාම නිලධාරි සහතිකය (මෙය ප්‍රාදේශීය ලේකම් විසින් අනු අත්සන් කලයුතුයි) (දිගකොළය)

03. ඉල්ලුම්කරුගේ පාස්පෝට් ප්‍රමාණයේ ජායාරූප 02 ක්
(මෙහි පිටුපස ග්‍රාම නිලධාරි සහතික කලයුතුයි)

04 ඉල්ලුම්කරුගේ මව - පියාගේ උප්පැන්න සහතික, ඡාතික හැඳුනුම්පත් හා විවාහ සහතිකයන්හි ජායා පිටපත්
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05 මව පියා දෙදෙනාම හෝ මින් එක් අයෙක් මියගොස් ඇත්නම් ඔවුන්ගේ මරණ සහතිකයන්හි ජායා පිටපත්
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06 මෙතෙක් උප්පැන්න සහතිකයක් ලබාගැනීමට ප්‍රමාද වීමට හේතු දන්වා ඉල්ලුම්කරු විසින් අධිකරණ වෛද්‍ය නිලධාරි වෙත ඉදිරිපත් කරනු ලබන ලිපිය.

(ඉහත ලිපි ලේඛන සියල්ල රැගෙන සදුදා, අඟහරුවාදා, බදාදා, බ්‍රහස්පතින්දා සිකුරාදා දිනයන්හි පමණක් පෙ.ව 10.30 ට පෙර පැමිණෙන්න) මේ සියලු ලියකියවිලි නිසි ආකාරයෙන් භාරදීමෙන් දින 3 කින් පසුව අවසන් වාර්තාව ලබාගත හැක.

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ශික්ෂණ රෝහල
බදුල්ල

Now patient comes to the JMOs office and start your MLE (Medico-legal examination) (A PC HO PC ELV is R3)

1) A- Authority – MLEF issued by the Police, court order, referral by anther consultant,
2) P- Preliminary data
    i. Basic ID features - Name, Probable age, Sex, address
    ii. Date and place of examination
    iii. Documents available with the client to identify the client.
        1. Birth certificate
        2. National identity document/passport
        3. School records
        4. Medical records
        5. Other official records
    iv. Documents issued by government officers to confirm the identification of the client
        1. Divisional secretary to the JMO
        2. GN to the JMO (DS should attest)
        3. Clients request letter
        4. Photographs (2 Passport size) – with GN signature
        5. Copies - Mother and father's –copies of BC, ID and MC (birth, identity and marriage) (if not available, GN letter)
        6. Copies - Mother and father's DC (if not available, GN letter)
3) C- consent
4) H- History - Circumstances of the examination –e.g.
    i. No birth certificate available
    ii. Identification of unknown persons
    iii. Uncertain or disputed age
    iv. Medico-legal investigations
    v. Immigration purposes
    vi. Court order
5) O- observations
6) P- preliminary investigations – photos, Traces, X-rays if indicated
7) C- clothing examination
8) E- Examination
    i. General physical examination- Assess features that may provide an approximate age.
        1. General body development
        2. Height/stature
        3. Weight
        4. Body habitus
        5. Skin changes
        6. Hair - Greying/baldness where relevant
        7. secondary sexual characteristics - tanners staging
            a. Distribution of body hair
            b. Facial hair in males

c. Breast development in females
d. Genital organs development

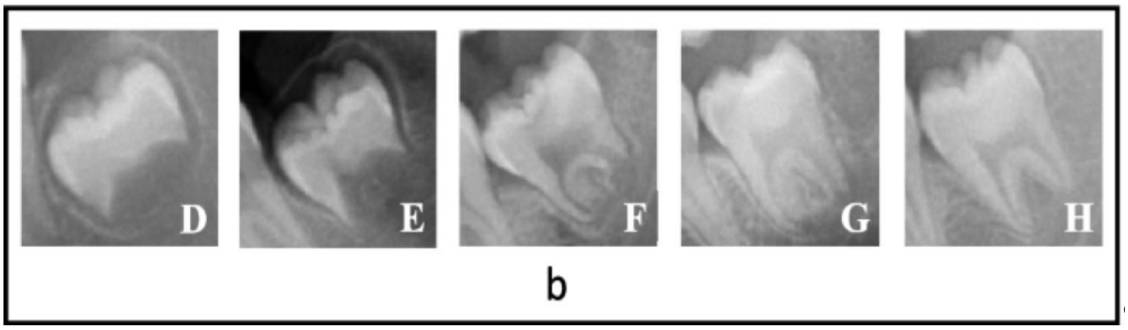
ii. Specific examination

1. Dental examination – preliminary assessment
    a. Perform a systematic examination of the teeth.
        i. Number of teeth present
        ii. Deciduous/permanent teeth
        iii. Eruption status
        iv. Missing teeth
        v. Dental restorations
        vi. Dental abnormalities
        vii. Development of unerupted teeth where radiographs are available
    b. Then refer to the consultant Dental surgeon.
        i. For younger individuals - assess **eruption and development of teeth.**
        ii. Elder individuals – assess Gustafson's technique.

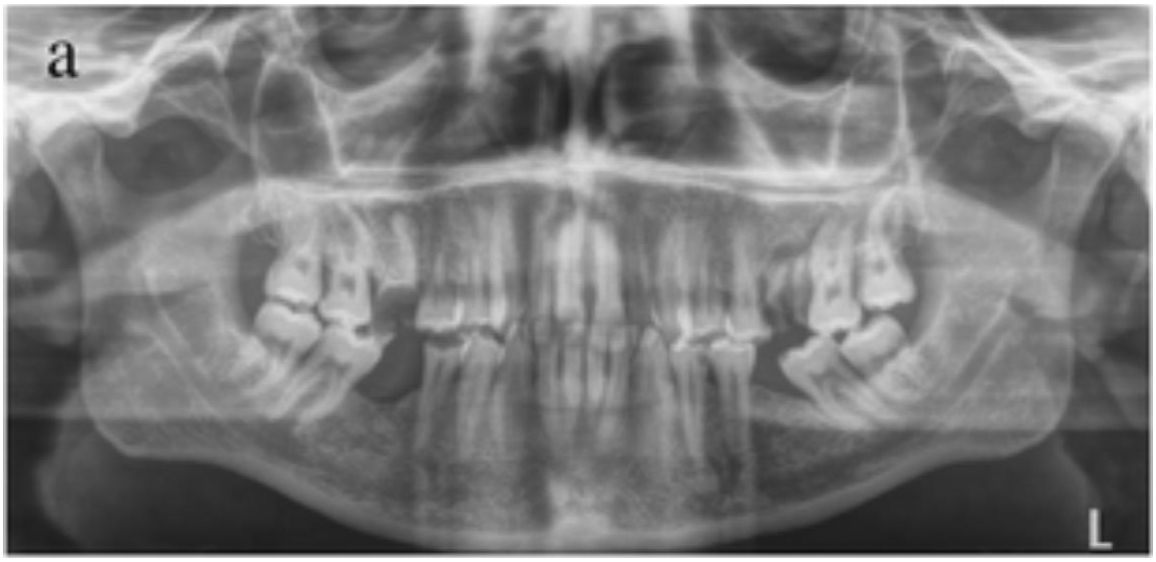
9) L- lab investigations

i. Dental radiographic examination- If required, obtain appropriate dental radiographs. E.g. Orthopantograms, apical views

1. Tooth development – Apical views
    a. Development of tooth crowns
    b. Root development
    c. Degree of root completion
2. Number of teeth Development (Orthopantograms)
    a. unerupted teeth
    b. Third-molar development

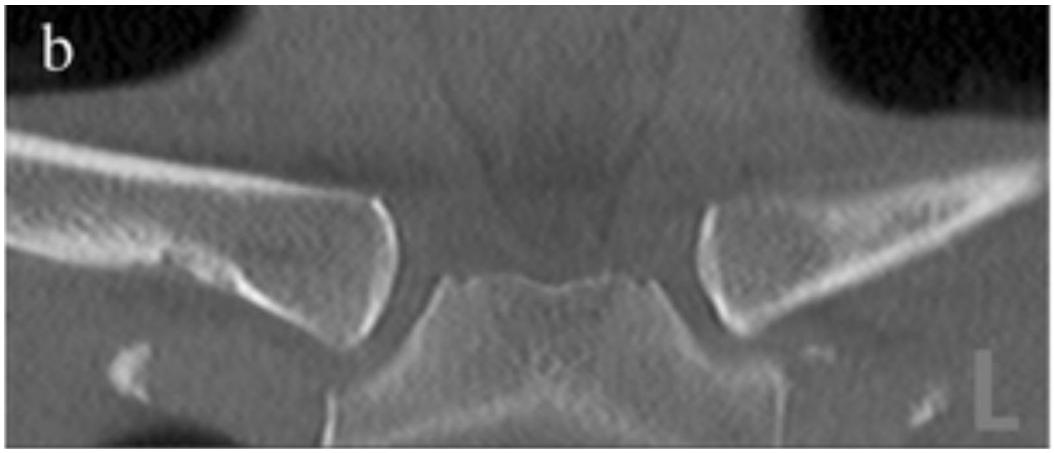




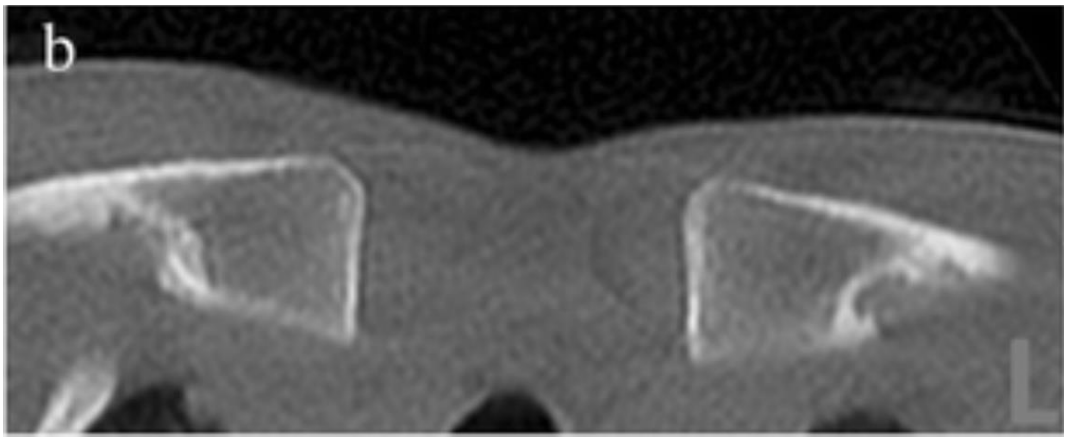


ii. Skeletal radiological assessment- preliminary assessment and then refer to the Consultant radiologist.
    1. Ossification centres appearence , – e.g. X-rays of
        a. hand and wrist and
        b. Foot and ankle
    2. Epiphyseal fusion,
        a. Upper limb X-rays - Wrist and hand, Elbow, Shoulder
        b. Lower limb X-rays - Hip, Knee, Ankle
    3. Bones size,
    4. Features of Skull
    5. Axial skeleton X-rays – larynx,
        a. Neck X-rays - Laryngeal changes - Ossification of thyroid and cricoid cartilage, Hyoid changes

b. Chest X-ray -
    i. Sternum changes
c. X-ray skull - Skull suture closure
d. vertebral column - lipping/degenerative changes



6. Features of pelvis - Pelvis X-rays
    a. Pubic symphysis changes
    b. Sacral fusion



10) V- visit to the scene
11) R- referral
    i. Consultant Dental surgeon (Forensic odontologist)
    ii. Consultant Radiologist (Forensic Radiologist)
12) R - Review and
13) R- report preparation - JMO Correlates all finding and determine an age range.

(9) Interpretation

If less than 25 years

(1) Dental finding interpretation

1. **Decidual teeth eruption - (6-24 months) (Ill in Mary Come Monday) (range at least +/- 1 year)**
    - i. **Incisor 1 -06 months**
    - ii. **Incisor 2 -09 months**
    - iii. **Molar - 1 -12 months**
    - iv. **Canine -15 months**
    - v. **Molar 2 -18-24 months**
        1. **2-6 years - 20 teeth**
        2. **2-6 years-** root calcification of milk teeth. it takes 2 years for the milk teeth roots to calcify after eruption,

2. **Permanent teeth eruption (from 6-24 years) (Mary Ill In Bed Baby Coming Monday Morning) (range at least +/- 1 year)**
    - i. **Molar 1 —- 6 years**
    - ii. **Incisor 1 — 7 years**
    - iii. **Incisor 2 —-8 years**
    - iv. **Bipolar 1 —9 years**
    - v. **Bipolar 2 —10 years**
    - vi. **Canine ——11 years**
    - vii. **Molar 2 —12 years**
    - viii. **Molar 3 —18-24 year**
        1. **12- 25 years-** Dental aging by using –
            a. Root calcification,
            b. Apical closure,
            c. 3rd molar eruption.



(2) Radiological findings – interpretation- By using

1. Ossification centres appearance,
2. Epiphyseal fusion,
3. Bones size,
4. Features of Skull and
5. Features of pelvis.

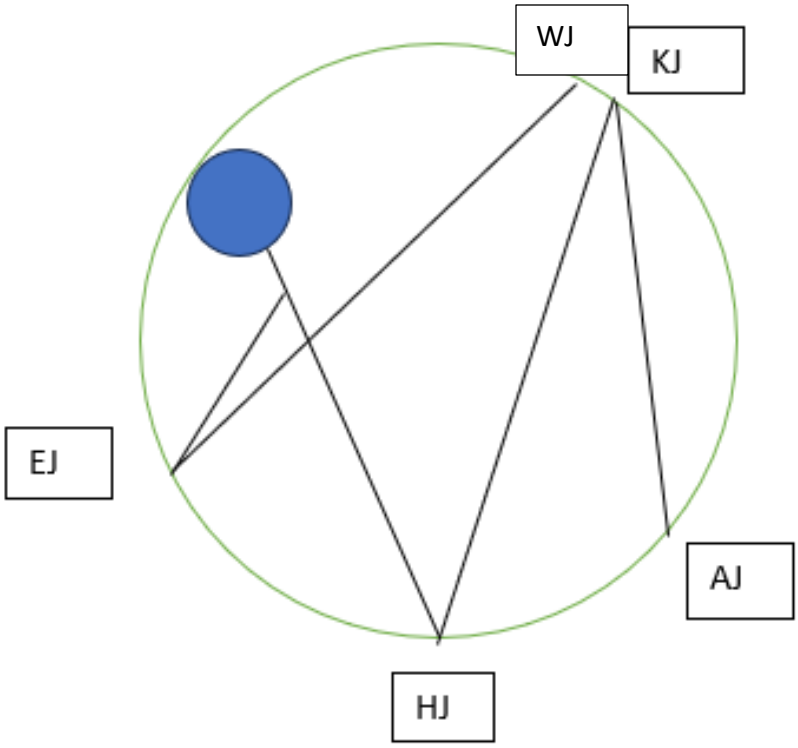
1) Ossification centres appearance-

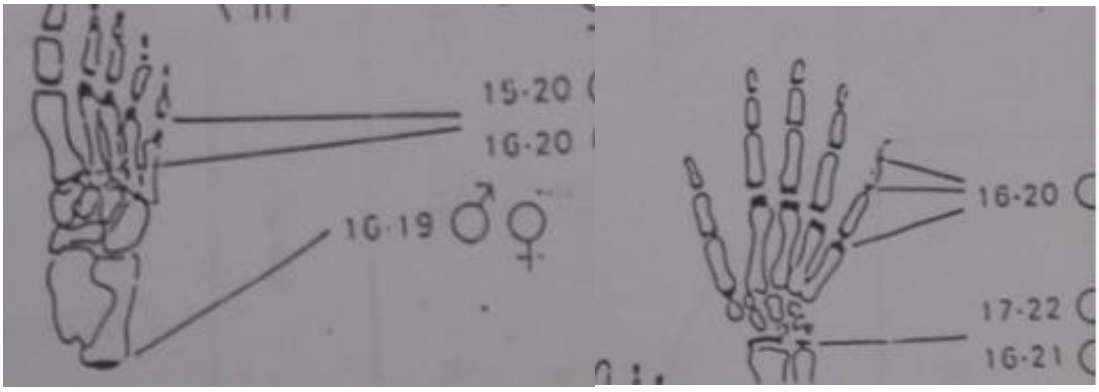
from birth to 15 years.

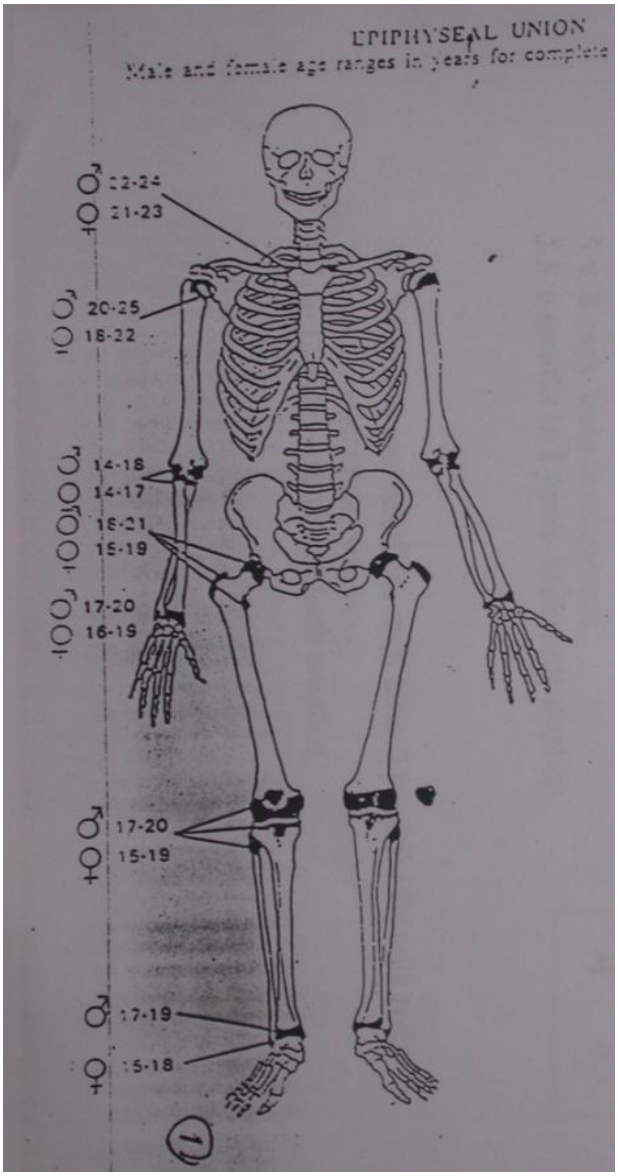
2) Epiphyseal union-

Occur from 10- 20 years. Roughly starts at 15 years. This is a process than an event. (Range of 1-4 years). Females are 2 years advance. X- rays – earlier value than real examination.

a. elbow joint- 16 (14- 18) years
b. hip joint- 17 (15- 19) years,
c. ankle joint- 18 (17- 19) years,
d. knee joint- 19 (17- 20) years,
e. wrist joint- 19 (17- 20) years,




15-20
16-20
16-19 ♂ ♀
16-20
17-22
16-21


EPIPHYSEAL UNION
Male and female age ranges in years for complete
22-24
21-23
20-25
18-22
14-18
14-17
16-21
15-19
17-20
16-19
17-20
15-19
17-19
15-18

3) Bone size –

1. Long bones length - can be used to assess age up to 6-7 years. (Intrauterine long bone length à can assess the length of the body à therefore can assess the Intra-uterine age).

4) Skull aging-

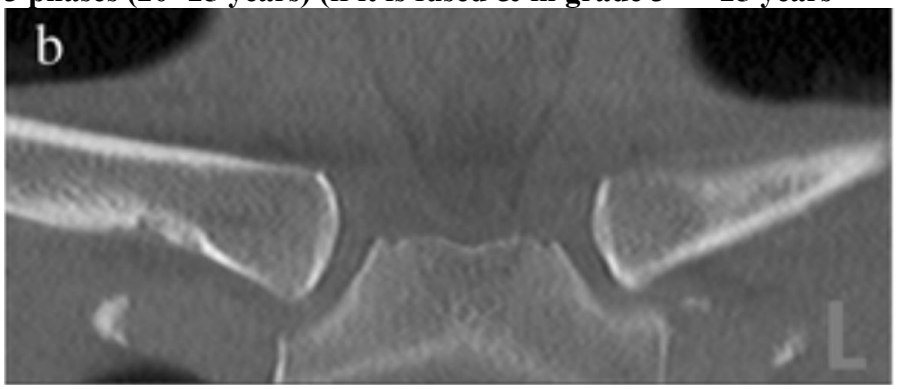
1. **3 months**- Posterior fontanels,
2. **1-2 years**- Anterior fontanels

5) Vertebral column –

1. New bone- 3 pieces
2. 1 year- 2 pieces
3. 6 years- one pieces

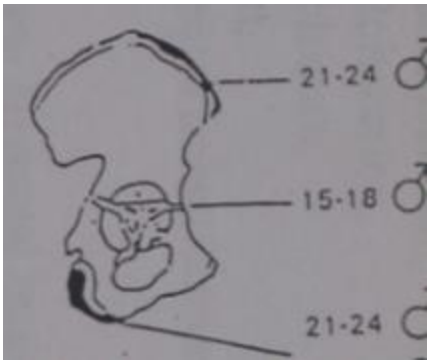
6) Medial clavicular fusion-

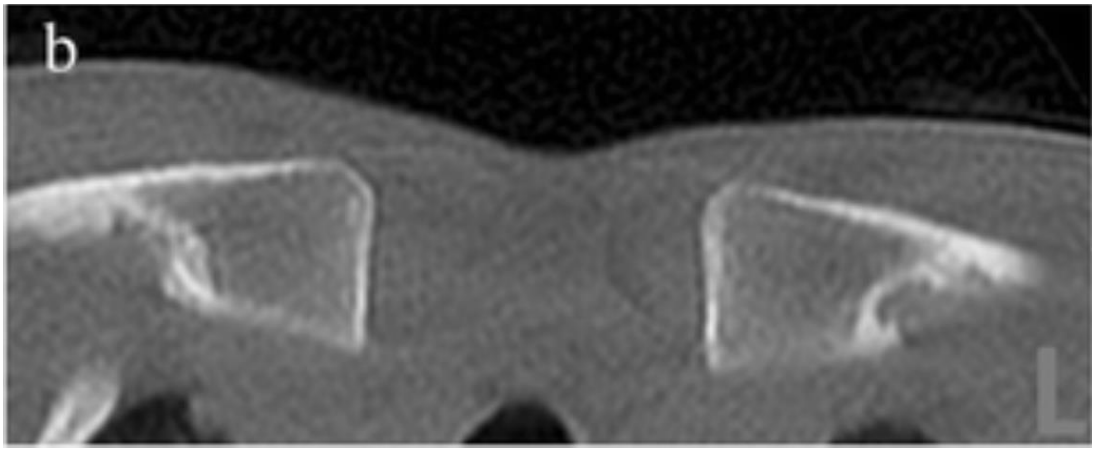
3 phases (20- 25 years) (if it is fused & in grade 3 - > 25 years



7) pelvis-

1. 15- 18 years- Y- cartilage fused-,
2. 21- 24 years- Ischial tuberosity fused,
3. 21- 24 years- Iliac crest fused
4. 21- 24 years – sacral segments are fused





Age assessment after 25 years

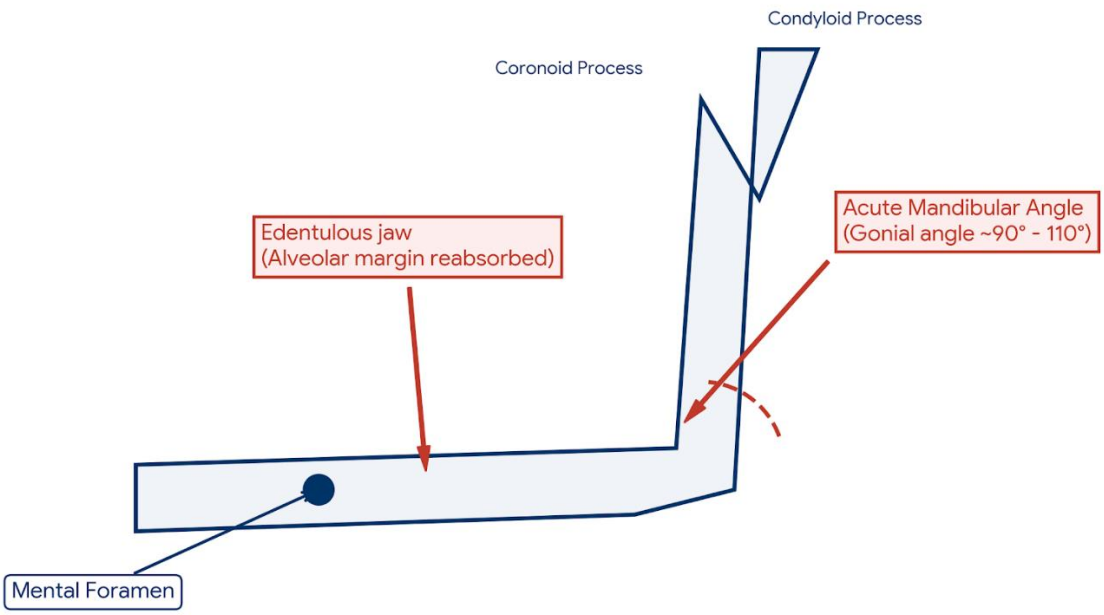
Increase the range with increasing age, therefore has to use Many methods as possible.

1) Physical examination

2) Teeth assessment – interpretation - refer to the consultant dental surgeon.

1. **Gustafsons method- (assess each and score each 0-3)**
    i. A - artesian - 0-3
    ii. P- Periodontosis (gingival margin gradually lowering) - 0-3,
    iii. S- secondary dentine - 0-3
    iv. **C- Cementum apposition**/secondary cementum -0-3
    v. R - Root resorption - 0-3
    vi. R - Root transparency - 0-3
2. **Pulp cavity width and length**- increase with age.

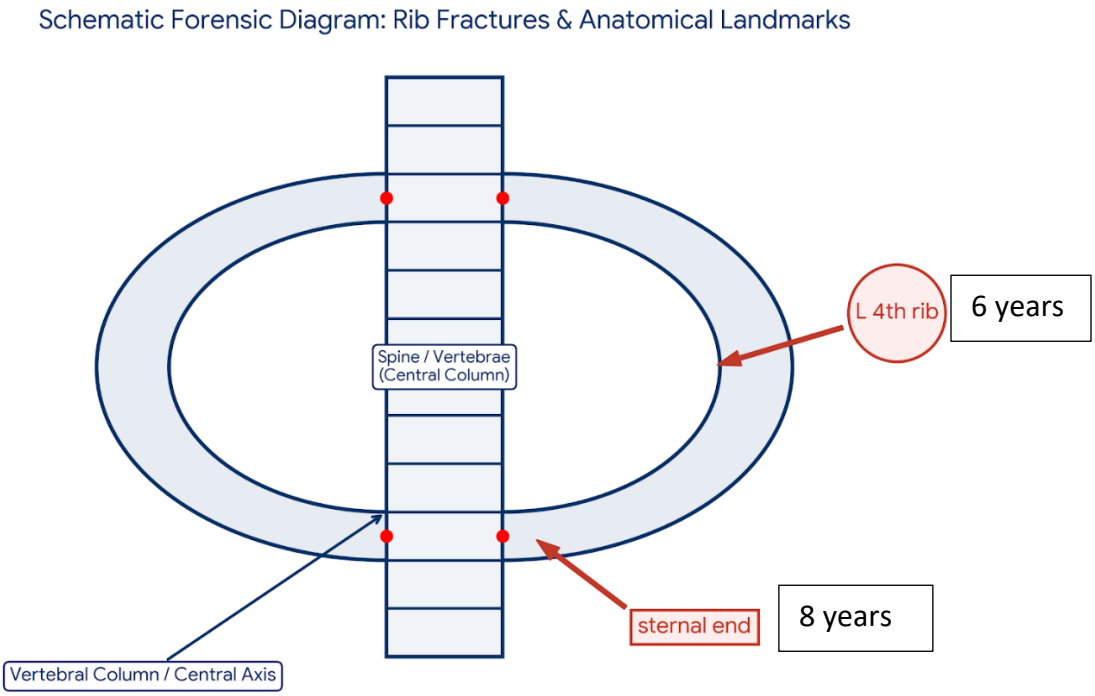
3. **Mandible changes - After 70 years**-
    i. Edentulous.
    ii. Mental foremen closer to alveolar margin.
    iii. Angle of the jaw is acute.



3) Radiological examination–interpretation - Refer to the consultant radiologist

1. **Skull suture fusion- 30- 60 years - External cranial suture fusion (mindle and love joy) – 30 – 60 years.** Each segment has 4 stages of fusion- 0, 1, 2, 3. therefore can asses the age.
    i. Lamboid closure begins - 25-30 years
    ii. sagittal Posterior 1/3 closure - 30-40 years
    iii. sagittal Anterior 1/3 + coronal lower 1/3 - 40-50 years
    iv. sagittal Middle 1/3 + coronal upper 1/3 - 50-60 years

2. **4th Sternal rib - 8 phases (20 – 70 years)- (iscan, lotth and write).-** Depends on sex and race.



3. Long bone X- rays-

i. Increase medullary cavity- rarifaction of the medullary (bone marrow) cavity.
ii. Cortical thickness decreases and cancellous bone thickness is increased.

4. Axial skeletal X-rays

i. Larynx
    1. Hyoid greater cornu fuses with the body - 40-50 years
    2. Thyroid and cricoid cartilage ossification - 45-50 years
ii. Sternum
    1. Xiphisternum fuses with body - 40-45 years
    2. Manubrium fuses with body - > 50 years
iii. Vertebra
    1. Vertebral lipping - 40-50 years
    2. Intervertebral disc space reduction - 50-60 years

(10) Reporting

The estimated age should be reported as an age range rather than as an exact age, together with methods and limitations considered.

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Medical Certificate of Age Estimation

Date: .....

Full Name of the examinee: .....

Address : .....

Sex : Male/Female

Referred by : .....

Date of commencement of medical examination: .....

Opinion

I am of the opinion that the medically estimated age of the above-named person is ..... as at .....

Signature of the Medical officer: .....

Name of the Medical officer: Prof/Dr: .....

Qualifications: .....

Designation: .....

(The most probable chronological age is based on the findings of the physical examination, mental assessment, dental aged estimation, and the radiological examination of the skeletal maturity where relevant)[3]

(11) Limitations

Age can be affected by,

- Race / population
- Sex
- Nutrition
- Diseases
- Hormonal / metabolic disorders
- Physical activities
- Environmental factors
- Individual variation

So **never base the final age solely on one parameter.**

(12) References

Textbook of Forensic Medicine and Toxicology 15th edition
Reddy KSN, Murty OP. The Essentials of Forensic Medicine and Toxicology. 35th ed.

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