

AGE ESTIMATION USING LATERAL CEPHALOGRAM, CVMI & OPG: A COMPARATIVE STUDY

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Abstract: *Background:* Age estimation is very essential in improving a biological profile from remains of human skeleton. The aim of the forensic anthropologist is to help medico legal officials for recognizing & presenting a average age range of the deceased. In adolescents, its done by examining all the skeletal structures which have degenerating nature with age in a predictable manner. Radiographs are one of the method used in age estimation in forensic investigations.

Objectives: This study aims to assess the efficacy of lateral cephalogram, CVMI & OPG in the assessment of age of an individual. *Material:* 90 lateral cephalogram & OPG of age group ranging from 10-25 years was taken from orthodontic department. *Methods:* Age estimation by lateral cephalogram was done by Rai et al method, CVMI by Lamparski's modification & OPG by Demirjian's method. *Results:* Data was subjected to regression analysis & results obtained were 86-88% by lateral cephalogram 71-72% by OPG & 64-68% by CVMI.

Keywords: Age estimation, cephalogram markers, CVMI & OPG

INTRODUCTION

The term "forensic" is a Latin word meaning forum or a place where legal matters are discussed. It's a science that deals with discipline associated with the application of technology for recognition & investigation of offence & administrating this for justice with efforts of multidisciplinary team.²

Age estimation plays a role in forensic medicine in identification of bodies & in connection with crimes.³

The process involved in age estimation in adults involves an exterior inspection of the body & calculation of skeletal & dental developmental stages.⁴

The ossification of the bone indicates the skeletal maturation. Even the sexual maturity also depends on skeletal maturation.

The changes occurs in every bone that can be appreciated radiographically. the changes that occur is same in every individual.. The scheduling differs.⁵

Surveys of the jaws & teeth have proved a simple & valuable technique in human identification because they are the most well conserved portions of human body.

Radiographs plays an crucial role in estimation of living organisms. Radiographs consumed in the procedure of age assessment, are indispensable tools in forensic odontology.^{6,7}

Dental radiographs are desirable pieces of antemortem evidence since they are highly objective in nature compared to other records.⁸

The technique of the stages of tooth development is best valued on radiographs seems to be more accurate in the approximation of age .

The radiographic methods are modest & include the recognition mineralization on roentgen pictures & their their comparison with average age range.⁹

The present study aims to measure, compare & evaluate various radiological landmarks as observed in lateral cephalogram, cervical vertebrae & orthopantogram, to asses their usefulness in age estimation. The study also aims to confirm between the noticed age predicted by radiographs readings(ceph markers), maturity variable(CVMI) & 3rd molar developmental variable(OPG) resulted in any improvement in age estimation.

The evaluation of lateral cephalogram is done by Rai et al method, CVMI by Hassel & Farman & OPG by Demirjian's method.

MATERIALS

90 lateral cephalogram & OPGs of patients with age ranging from 10-25 years among them 72 females & 18 males were taken from orthodontic department who have come for the orthodontic treatment.

Cases with congenital & skeletal anomalies of teeth or jaw were excluded.

METHODS

1. For **lateral cephalogram the Rai et al** method was used (fig1 & 2) These were traced & measured in mm.
2. For **6 cervical vertebrae maturation indicators[CVMI]** method used was modification of **Lamparski's criteria**.¹⁰(FIG:3 & TABLE 1)

Radiological in adults, the determination of age would be thought-provoking as the development of dentition is finished.¹¹

- 3 **Demirjian's classification** was used for 3rd molar development FIG(4)

1. Stage A: The tips of cusps started mineralizing but not yet fused
2. Stage B: These mineralized cusp are fused & the fully formed crown is cleared defined.

3. Stage C: Pulp chamber is marked & dentinal deposition has been started.
4. Stage D: Crown is finished to DEJ; pulp chamber has trapezoid
5. Stage E: The inter-radicular bifurcation has begun; The crown length is greater than root length.
6. Stage F: The crown length is smaller than the root length ; Root endings are funnel shaped.
7. Stage G: Roots are equivalent but apices remain disclosed.
8. Stage H: Apical ends of the root are entirely sealed

RESULTS

- Regression analysis was performed by using the regression equation $Y = a + b(x)$ where 'Y' is dependent variable, 'a' is constant, 'b' is Regression co-efficient & 'x' is independent variable .
 - Determination of co-efficient(R^2) & standard errors(SE) were obtained for all the three radiographic methods
 - Gender specific formulas for age determination were also derived(fig:4)
- The Statistical data was subjected by SPSS[Statistical package for social sciences] 20.0 version software.
- TABLE 2, 3 & 4**

DISCUSSION

In our study as per regression analysis the R^2 reading ranged from 86-88% in lateral cephalogram, 71-72% in OPG & 64-68% in CVMI. Higher the R^2 better is the prediction of age. This indicates that lateral cephalogram analysis can predict age better than CVMI & OPG.

In cephalometric analysis ramus height, body length & mandibular length did not show much variation in R^2 reading. Hence any one of these measurements can be reliably used for age prediction. Patients included in our study are more than 50% who have reached their maturation hence lateral cephalogram is giving more accuracy in age estimation.

According to **Daya K. Jangam**¹² et.al in their study they found the lateral cephalogram is more reliable method than OPG for age estimation which is correlating with our study.

In our study there was no significant difference between right & left side of 3rd molar for the assessment of developmental stages. This finding is coincident with **Jashwant**¹³ et al.

According to our study the CVMI results obtained are least accurate for age estimation because more than 50% of the patients included in our study have reached their maturation stage. Hence this says that CVMI holds good for the growing age group.

Kohler¹⁴ et al the growth of last molar cannot be measured without the commencement of calcification or when they are missing. The absence of tooth itself is self explanatory about the age. Hence he built four assumption replicas. 1st maxillary molar & mandibular molar existing; 2nd maxillary molar existing; 3rd mandibular molar existing & 4th no third molars existing. To extract greatest facts from each patient, the analysts used, support with the missing configuration of the patients.

CONCLUSION

- Age estimation with lateral cephalogram, CVMI & OPGs can be used to make a significant prediction in areas of forensic dentistry.
- The measurements & examination of skeletal & teeth are required to obtain accurate & reliable age estimation.

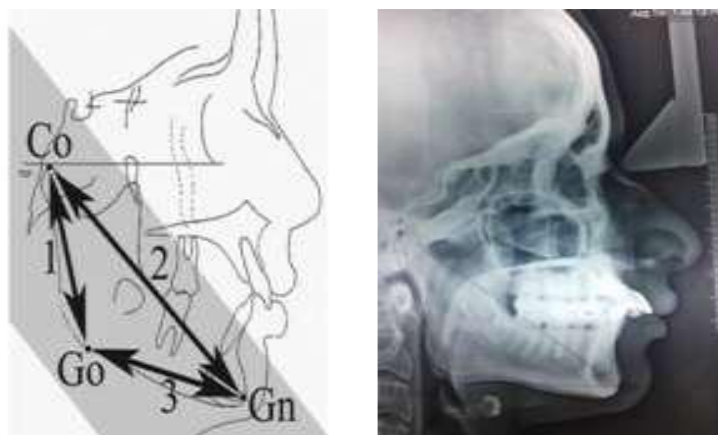


FIG:1& 2 Co(Condylion),Go- Gonion , Gn- Gnathion; The mandibular ramus height Co-Go; The mandibular length Co-Gn; The mandibular body length Go-Gn

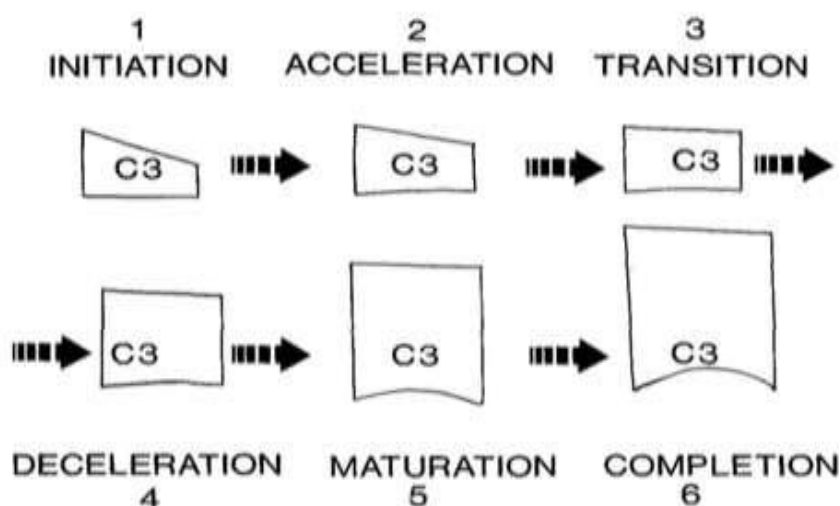


Figure: 3 Stages of CVMI

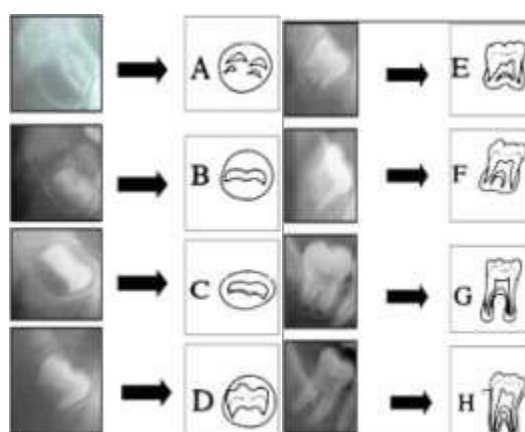


Fig:4 Demirjian's classification system

These developmental stages are expressed in numbers as follows:

STAGE 0=0, STAGE A=1, STAGE B=2, STAGE C=3, STAGE D=4, STAGE E=5, STAGE F=6, STAGE G=7, STAGE H=8

TABLE: 1

CVMI(stage)	Males age(yrs)	Females age(yrs)
CVMI-1	11.6	10.4
CVMI-2	12.3	10.7
CVMI-3	13.2	11.8
CVMI-4	14.2	12.8
CVMI-5	15.7	14.3
CVMI-6	17.2	16.3

Statistical analysis: Regression analysis was performed & determination of co-efficient(R^2) & standard errors(SE) were obtained for all the three radiographic methods & Gender specific formulas for age determination were also derived.

TABLE:2

Group	Cephalogram measurement	Regression equation $Y = a + b(x)$	R^2	SE of the estimate
Male	Ramus height (Co-Go)	Age=6.7+1.64(Co-Go)	88.7%	4.216
	Body length (Go-Gn)	Age=6.3+1.36(Go-Gn)	87.2%	3.854
	Mandibular length(Co-Gn)	Age=5.4+0.92(Co-Gn)	88.4%	3.642
Female	Ramus height (Co-Go)	Age=6.6+1.71(Co-Go)	86.4%	3.962
	Body length (Go-Gn)	Age=6.4+1.41(Go-Gn)	86.0%	3.496
	Mandibular length(Co-Gn)	Age=5.6+0.95(Co-Gn)	86.3%	3.786

TABLE: 3

Group	Regression equation $Y = a + b(x)$	R^2	SE of the Estimate
Male	Age=8.26+1.39(CVMI stage)	68.4%	1.02
Female	Age=5.07+2.32(CVMI stage)	64.5%	1.36

TABLE: 4

Group	Regression equation $Y = a + b(x)$	R^2	SE of the Estimate
Male	Age=9.34+1.62(DS)	72.2%	1.08
Female	Age=8.52+1.84(DS)	71.1%	1.03

- DS-Developmental stages
- R^2 - indicates the proportion of the explained variability in the response variable age. The variable that leads to highest R^2 contains the maximum amount of information on age
- SE-denotes the standard error of the estimate

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