Original communication

Dental age estimation among female commercial sex workers in Goa

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ABSTRACT

Introduction: Age estimation is a sub-discipline of the forensic sciences and an important part of every identification process, especially when information relating to the deceased is unavailable.
In India, close to 3.5 million women work as commercial sex workers (CSW) of which 1.2 million are under aged.
Aim: To assess the dental and the skeletal age of rescued female CSWs with an intention of rehabilitation of the minors.
Methodology: Dental age assessment of 32 rescued female CSWs with unknown age was done based on the radiographic analysis using regression equations derived in a Qualitative and Quantitative study by Dinkar A D. The skeletal age was assessed based on physical and radiological examination of the skeletal bones by Forensic experts.
Result: It was observed that the estimated age of the CSWs ranged from 7 to 22 years out of which 22 cases (68.75%) were found to be below 18 years. When the dental and skeletal age was compared the maximum variation ranged between ±12 months (1 year). Although the CSWs were found to be from different parts of India, maximum number of the cases (50%) was from Andhra Pradesh and one case (3.13%) was from Nepal.
Conclusion: Dental age assessment using qualitative and quantitative method given by Dinkar A D can be thought of a reliable method for dental age assessment as it didn't show much variation when compared to the skeletal age of the 32 CSWs. In the present study 68.75% of the females were minor which shows that the number of minors being trapped in the trade of prostitution is increasing. Rescuing and rehabilitation of these minors is of paramount importance.

1. Introduction

Age estimation is a sub-discipline of the forensic sciences and an important part of every identification process, especially when information relating to the deceased is unavailable. Its importance in medico-legal cases is priceless when it comes to judicial punishment, rape, kidnapping, employment, attainment of majority, social benefits and marriage. Although there are skeletal, dental and sexual maturity indicators, dental maturity indicators has received more attention because of the low variability of dental indicators compared with sexual & skeletal age estimation that are more affected by the endocrine & nutritional status of the children and adolescents.[1] In India close to 3.5 million women work as commercial sex workers (CSW) of which 1.2 million are under aged.[2] Child prostitution is a major problem in India. They are pushed into the trade at a young age, at times even before they enter the puberty and thus are not aware of the trap they are falling into. Whereas some young people enter into this setup due to homelessness, family breakdown, influence of others, poverty, drug or alcohol abuse, educational underachievement or unemployment. Once they are trapped into this trade they are subjected to physical and mental torture which leaves a deep physical and psychological scar. Hence preventing child prostitution is of paramount importance.

The present study was undertaken with an aim of assessing the dental and the skeletal age of rescued female CSWs with an intention of rehabilitation of the minors.

2. Methodology

The sample size included 32 female CSWs with unknown age who were rescued and referred to Oral Medicine & Radiology

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department, Goa Dental College, Goa - India from Forensic Medicine department, Goa Medical College, Goa for dental age assessment. Panoramic Radiograph and Intra oral peri-apical (IOPA) radiograph of mandibular right and left premolar and molar region was taken using paralleling cone technique.

Dental age assessment was done based on the radiographic analysis using regression equations derived in a Qualitative and Quantitative study by Dinkar A D.[3]

For the Quantitative Analysis, calcification sequence of mandibular first and second premolars (P_1 & P_2) and second permanent molars (M_2) was assessed based on 14 stage scale given by Moorees et al.[4] The sequence of calcification was recorded as P_2M_2 when calcification of P_2 was more advanced than M_2, M_2P_2 when it was the other way and when P_2M_2 appeared equally advanced in calcification it was recorded as (P_2M_2). Occluso — apical length of the calcified tooth structure of P_1, P_2 & M_2 was recorded in millimetre and then was substituted in the regression equations given by Dinkar A D.[3] [Table 1].

Thus the age was calculated for P_1, P_2, M_2 and the average of all three was considered as the age of the person assessed by quantitative analysis.

For the qualitative analysis, stage of tooth formation was assessed with reference to the Gleiser & Hunt's 15 calcification stages.[5] The stages were then converted into the ages using a calcification stage — age completed chart given by Dinkar A D. [Tables 2A and 2BA].[3]

Thus the average of the ages corresponding to the calcification status of the maxillary and mandibular teeth was given as a final age as per qualitative analysis. Finally, the average age of qualitative and quantitative analysis was given as a final estimated dental age.

The skeletal age was assessed based on physical and radiological examination of the skeletal bones by Forensic experts from Forensic department, Goa Medical College, Goa based on the appearance and fusion of the ossification centres.[6]

3. Results

It was observed that the estimated age of the CSWs ranged from 7 to 22 years out of which 22 cases (68.75%) were found to be below 18 years [Fig. 1].

When the dental and skeletal age was compared the maximum variation ranged between ±12 months (1 year).

Table 1
Regression equations of age (Y) on calcified length (X) of P_1, P_2 & M_2 in males and females for different calcification sequences. (X in mm. Y in yrs).

Calcification sequence	Tooth	Sex	Regression equation
P_2M_2	P_1	M	$Y = 0.3905X + 3.7653$
		F	$Y = 0.3989X + 3.7604$
	P_2	M	$Y = 0.4185X + 3.9321$
		F	$Y = 0.3836X + 4.4160$
	M_2	M	$Y = 0.4681X + 4.4805$
		F	$Y = 0.4747X + 4.4619$
(P_2M_2)	P_1	M	$Y = 0.4419X + 3.7988$
		F	$Y = 0.3794X + 4.2950$
	P_2	M	$Y = 0.4519X + 4.2053$
		F	$Y = 0.4192X + 3.9616$
	M_2	M	$Y = 0.4547X + 4.2343$
		F	$Y = 0.4473X + 3.7890$
M_2P_2	P_1	M	$Y = 0.4129X + 4.0900$
		F	$Y = 0.4179X + 4.0270$
	P_2	M	$Y = 0.4736X + 4.6756$
		F	$Y = 0.4602X + 4.6305$
	M_2	M	$Y = 0.4120X + 4.3360$
		F	$Y = 0.4001X + 4.1509$

Table 2A
Calcification stage — age completion chart.

Completed age	Calcification stage
+4 yrs	Root completed with apex closed
+3 yrs	Root completed with apex open
+1½ yrs	75% root completed
Eruption Time	50% root completed
−9 mths/$^3/_4$ yrs	25% root completed
−1½ yrs	Crown completed
−2½ yrs	75% Crown completed

Although the CSWs were found to be from different parts of India, maximum number of the cases (50%) was from Andhra Pradesh and 1 case (3.13%) was from Nepal [Fig. 2].

4. Discussion

Forensic age estimation defines an expertise in forensic medicine which aims to define in the most accurate way the chronological age of person of an unknown age involved in judicial or legal proceedings. In this expertise a collaborative knowledge of forensic and physical anthropology, odontology and radiology are required.

Assessment of tooth development to estimate the age of living subjects has a long history. In industrial sociology, the presence of the first permanent molar was a sign that a child had attained six years of age and such children were condemned to working in the coal mines of the 19th century industrial revolution in England.[7] Teeth are one of the key systems in the body and their degree of development is used as one of the indices of biological age. The methods based on the stages of tooth formation and the morphological parameters of teeth as appreciated on radiographs seems to be more appropriate in the assessment of age than those based on skeletal development as the dental development and calcification is controlled more by genes than by environmental factors.[8] They are less susceptible to nutritional, hormonal and pathological changes too.

In the present study also the dental age estimation was based on the calcification stage of the teeth and correlating them with calcification stage — age chart given by Dinkar A D.[3] For establishing the maximum reproducibility, it is always advisable to apply the different techniques and perform repetitive measurements and calculations,[9] and hence the authors have done quantitative assessment of the age based on the length of the calcified structure of P_1, P_2 and M_2 and using these values in the regression equations derived by Dinkar A D.[3] Estimation of the age based on the skeletal growth was also considered which showed maximum variation of ±12 months. Hence the authors feel that the estimated age of the subjects in the present study is reliable since it was based on a variety of techniques.

While the legality of adult prostitution varies between different parts of the world, the prostitution of the minors (under the age of

Table 2B
Calcification stage — age completion chart.

	Completed age				Stage of calcification
	4 to 5 mths	−6 yrs	−8 yrs	−9 yrs −10 yrs	Initial calcification
	1 to 2 mths	−7 yrs	−9 yrs	−10 yrs - 11 yrs	Presence of crypt
	3 mths IU life	−8 yrs	−10 yrs	−11 yrs −12 yrs	Absence of crypt
Teeth	Canine	Incisors, 1st molars	Pre -molars	2nd molars 3rdmolars	

IU — Intra Uterine.