SKELETAL MATURATION EVALUATION USING MANDIBULAR SECOND MOLAR CALCIFICATION STAGES

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ABSTRACT

Objective: To examine the relationship between skeletal maturity and mandibular second molar calcification stages and assessing mandibular second molar as a diagnostic tool for skeletal maturity evaluation.

Study Design: Cross sectional study.

Place and Duration of Study: Orthodontic department, Sandeman Provincial Hospital, Quetta, from Jan to Jun 2019.

Methodology: The sample size of the study 240 comprised of equal number of males and females. Inclusion criteria was defined to include the patients (male and female) with the age from 9-16 years; on the same time, patients without facial asymmetry and without prior history of facial or neck trauma/injury or surgery were considered for the present study. Exclusion criteria was defined to exclude those patients from the study who had the history of bone disease and major illness in past; known cases of muscular dystrophy; any congenital malformation of cervical vertebrae and tooth caries; Low quality x-ray with poor contrast.

Results: The study revealed association between Demirjian Index and Cervical Vertebræ Maturation Index stages (0.875) with the statistical significance. Demirjian Index Stage H indicated the greater percentage distribution at stage 4 and 6 of Cervical Vertebræ Maturation for males. Similarly, in females, demirjian index stages G and H showed the greater percentage at stage 4 and 6 of cervical vertebrae maturation index respectively.

Conclusion: Analysis indicated that cervical vertebrae maturation index and Demirjian Index (DI) occurred earlier in females than males.

Keywords: Cervical vertebrae maturation, Mandibular second molar calcification, Skeletal maturation.

INTRODUCTION

Assessment of dental development and skeletal maturity is a clinical practice which is common in most of health professions particularly for growth modification in orthodontic. In growing patients, orthodontic treatment with jaw discrepancies involved growth modification with the use of orthopedic functional appliances. In 1975, Lamparsky indicated that morphologic changes in cervical vertebrae can also be used alternatively for the evaluation of skeletal maturity. Specific stages of physiologic maturity is base of the maturity state of a child then chronological age.

For assessing the skeletal maturity inclusive of chronological age, dental development, there are different methods which has been supported by various authors determining skeletal maturity on the basis of radiographs of specific structures, such as epiphysis diaphysis fusion of long bone, and fusion of the sphenoid bone with basilar part of the occipital bone. For the evaluation of adolescent development, the epidemic age of the examined tooth and the mineralization of second molar calcification stages on panoramic radio graph has been described in demirjian method by which dental maturity can be determined. For the evaluation of dental maturity of young children (<6.5), demirjian method is found to be an accurate method. In case of less old children dental maturity assessment is a simple procedure to execute on panoramic radio graphs used for various purposes.

There is a highest correlation indicated between mandibular second molar calcification stage and skeletal maturity in comparison of other teeth Demirjian et al index described that there are 6 maturation stages of cervical vertebrae as suggested by Rajagopal et al; whereas there are eight stages (A to H) of mandibular second molar tooth calcification as defined by demirjian index.

It was an objective of the study to assess skeletal maturational age with the use of mandibular left second molar to carry out on panoramic radio graphs and comparing it with cervical vertebra maturation index (CVMI) by hassal and farman on lateral Cephalometric considering as standard. There are several studies on skeletal maturity indicators, however researchers paid a little attention to the relations between cervical vertebra maturation index (CVMI) and mandibular left second molar calcification stages. A research was
conducted on 300 patients with age ranging from 9-18 years. In that research, CVMI and mandibular second molar calcification stages were compared. Results indicated the strong association between CVMI and DI (r= 0.854 for males and r=0.866 for females)\(^1\).

**METHODOLOGY**

This descriptive cross sectional study was conducted in Sandeman Provisional Hospital Quetta, from January to June 2019. Sample size was set to 240. Non-probability consecutive technique was used as sampling technique for the collection of data.

Inclusion criteria was defined to include the patients (male and female) with the age from 9-16 years; on the same time, patients without facial asymmetry and without prior history of facial or neck trauma/injury or surgery were considered for the present study. Furthermore, those patients, whose bones appeared clearly on the radio graph and first four cervical vertebrae inferior border were clear.

Exclusion criteria was defined to exclude those patients from the study who had the history of bone disease and major illness in past; known cases of muscular dystrophy; any congenital malformation of cervical vertebrae and tooth caries; low quality x-ray with poor contrast.

Previous history of bone disease and major illness in past; known cases of muscular dystrophy; any congenital malformation of cervical vertebrae and tooth caries; Low quality x-ray with poor contrast.

Visual inspection by Hassal and Farman et al was used for evaluating CVMI. This method determined anatomical changes of C2, C3, and C4, evaluated concerning two sets of variables: (1) the presence or absence of a concavity in C2 (odontoid process), C3, and C4 at the inferior border and (2) Shape differences of the body of cervical vertebrae with the progressive ages, with the consideration of four shapes. The variables were subdivided into six consecutive stages in cervical maturation (CVMI-1-CVMI-6). Six cervical vertebral maturation (CVMI) index according to Rajagopal et al.

This study used Demirjian Index (DI) method 1 is for evaluating left mandibular second molar on panoramic radiographs from stage A to stage H.

The data entry and analysis was done using program SPSS ver 20. Frequencies and percentages of the categorical variables i.e. CVMI and DI stages were presented and compared by using ANOVA. The age distribution of patients was plotted in MS Excel as shown in figure.

![Figure-I: Age distribution.](image)

**RESULTS**

Total number of respondents was 240; and the gender distribution shows that 120 (50%) were males and 120 (50%) were females. Mean age was calculated to be 13.87 ± 2.099 years.

The frequency distribution of various stages of CMVI across each of the gender as shown in the table-II along with the mean age of patients. From total 240 patients, 35 (14.5%) males and 36 (15%) females were reported for CMVI 6 with the mean age of 16.66 and 15.48 years respectively as shown in the table-I.

| Gender | Age (Mean ± SD) |
|--------|-----------------|
| Male   | 14.22 ± 2.03    |
| Female | 13.11 ± 2.01    |

**DISCUSSION**

In the clinical practice, the assessment of growth of patients’ status is very important. Skeletal maturity assessment and dental development is very common
clinical practice in the number of health professions, particularly for growth reform inorthodontics and dentofacial orthopedics and for the age estimation in forensic sciences. This cross-sectional study was conducted in an effort to clarify the relationship between mandibular second molar calcification stage and skeletal maturation among a group of Pakistani orthodontic patients.

Previous studies reported racial variations between individual teeth calcification stages and skeletal maturity. Consequently, this study was planned examined the relationship between the stages of calcification of mandibular second molar teeth and skeletal maturity stages in this population.

The developmental status of an individual is usually assessed in connection to physical events taking place during the progress of growth. Therefore Indicators of developmental age are more informative than chronological age, specifically for age estimation and clinical application.

DI stage H indicated the greater percentage distribution at stage 4 and 6 of CVM for males. Similarly, in females, DI stage G and H showed the greater percentage at stage 4 and 6 of CVMI respectively. Our findings presented different results in comparison to the findings of Kumar et al. Their research reported the peak skeletal growth spurt at slightly different stages of dental maturity. The significant findings from the study of Vijayashree et al indicated that mandibular second molar calcification stages are considered as the reliable indicator of skeletal maturity, which can be used for the prediction of growth status in the way to determine the optimal timing of treatment.

CONCLUSION

Frequency distribution of DI stages indicated greater percentage at stage 4 and 6 of CVMI in males. Similarly, DI stage G and H showed the greater percentage stage 4 and 6 of CVMI in females respectively. Analysis indicated that cervical vertebrae maturation index and demirjian index (DI) occurred earlier in females than males.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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