

## Assessment of Demirjian stage of third molar which can accurately predict 18 years of age in North Indian population

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### Abstract

**Background:** According to section 3(1) of the Indian Majority Act 1875 every person domiciled in India shall attain the age of majority on completion of 18 years and not before. Demirjian described the 8 stages of development of teeth. Third molar development occurs around the age of 18 years. So, if we can determine that which Demirjian stage/stages of third molar show that the person is below 18 years and which Demirjian stage/stages of third molar show that the person is above 18 years of age, then it can be very helpful for the medicolegal cases where any legal document for age is not available. **Materials and Methods:** In this study, 101 OPG radiographs of north Indian patients with a known chronological age between 14 to 25 years were taken from Department of orthodontics, Darshan dental college and hospital, Udaipur, Rajasthan. Total 371 third molars were seen on these radiographs. The stages of third molar development were assessed using the eight-stage scheme developed by Demirjian and then these stages were to be co-related with chronological age. Then mean age was evaluated for each stage of third molar. Then stages below 18 years of age and stages above 18 years of age were evaluated. **Results and Observation:** Data revealed that at stage C, a person was probably be below 18 years (minor) and at stage H an individual was probably be above 18 years (Major). **Conclusion:** The stages of third molar development can be reliably used to estimate the chronological age of an individual in his late teens to early twenties and at stage H an individual is probably be above 18 years depicting third molar root completion and at stage C an individual is probably below 18 years of age depicting third molar root in developing position. So, in living individual, third molar maturity is the best age estimation method as it is non-invasive and usable dental images are easily obtained.

**Keywords:** Third molar, Demirjian, Medicolegal, OPG, Minor, Major

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### Introduction

Ageing is a natural, unavoidable and irreversible phenomenon to any living thing in Universe. In animate things aging is characterized by initial stages of development followed by growth and then tissue remodelling. Ageing is associated by constant change in physical state of an organism and any stage of this characteristic process can be correlated with corresponding age as such. This process may gain status of investigation, and could help in identification of certain details of a person [1-3]. In young children, the use of biological indicators such as epiphyseal fusion, changes of the pubic symphysis, wrist bones and fusion of cranial sutures are credible. But in late teen to early twenties these biological indicators are not credible. Teeth contribute as a reliable means of determining age from approximately 10 weeks intrauterine up to old age [4]. In children, dental age is estimated by comparing the dental developmental status of the child, whose age is unknown, with published dental developmental charts and table [5-9]. However, after the early teens most teeth have completed their growth and erupted except for the third molars. This makes the third molar development is the most important choice for age assessment from late teens to early twenties. According to section 3(1) of the Indian Majority Act 1875 every person domiciled in India shall attain the age of majority on completion of 18 years and not before. Demirjian et al [8] described the 8 stages of development of teeth. Third molar development

occurs around the age of 18 years. So, if we can determine that which Demirjian stage/stages of third molar show that the person is below 18 years and which Demirjian stage/stages of third molar show that the person is above 18 years of age, then it can be very helpful for the medicolegal cases where any legal document for age is not available. Aim of this study was to evaluate that which Demirjian stage/stages of third molar comes before 18 years of age and which Demirjian's stage/stages of third molar comes after 18 years of age so we can accurately predict that the person is minor or major.

#### Materials and methods

In this study, 101 OPG radiographs of north Indian patients with a known chronological age between 14 to 25 years were taken from Department of orthodontics, Darshan dental college and hospital, Udaipur, Rajasthan. Total 371 third molars were seen on these radiographs. The stage of third molar development was assessed using the eight-stage scheme developed by Demirjian (Figure 1 to Figure 7) and then these stages were to be co-related with chronological age. Then mean age was evaluated for each stage of third molar. Then stages which comes below 18 years of age and stages which comes above 18 years of age were evaluated. Descriptive analysis of data is done. Frequency distribution of the number of third molars present on each of the 101 evaluated orthopantomograms is shown in table 1.

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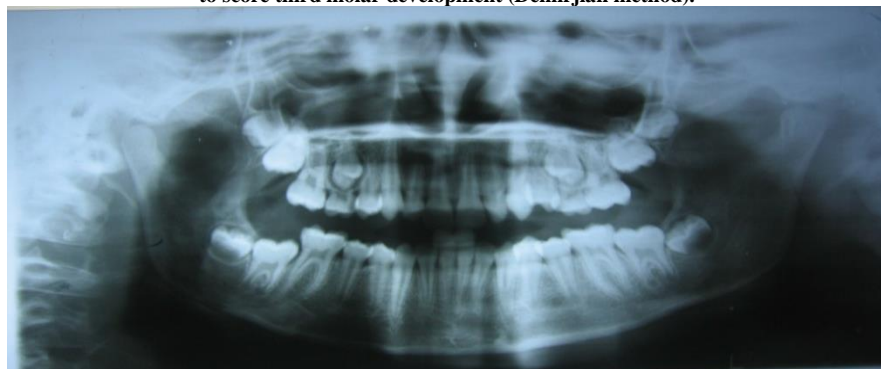
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**Table 1: Frequency distribution of the number of third molars present on each of the 101 evaluated orthopantomograms.**

Number of III molar teeth present	Number of patients	Number of teeth evaluated
1	1	1
2	11	22
3	8	24
4	81	324
Total	101	371

<b>A</b>		Cusp tips are mineralized but have not yet coalesced.	<b>E</b>		Formation of the inter-radicular bifurcation has begun. Root length is less than the crown length.
<b>B</b>		Mineralized cusps are united so the mature coronal morphology is well-defined.	<b>F</b>		Root length is at least as great as crown length. Roots have funnel-shaped endings.
<b>C</b>		The crown is about 1/2 formed; the pulp chamber is evident and dentinal deposition is occurring.	<b>G</b>		Root walls are parallel, but apices remain open.
<b>D</b>		Crown formation is complete to the dentinoenamel junction. The pulp chamber has trapezoidal form.	<b>H</b>		Apical ends of the roots are completely closed, and the periodontal membrane has a uniform width around the root.

**Fig 1: Radiographic images with corresponding schematic drawings and definitions of the eight stages of crown and root formation used to score third molar development (Demirjian method).**



**Fig 2: This O.P.G. of 14 years old subject shows third molar in 'C' 'C' 'C' 'C' stages of development in relation to 1st, 2nd, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.**



**Fig 3: This O.P.G. of 15 years old subject shows third molar in 'D' 'D' 'D' 'D' stages of development in relation to 1st, 2nd, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.**

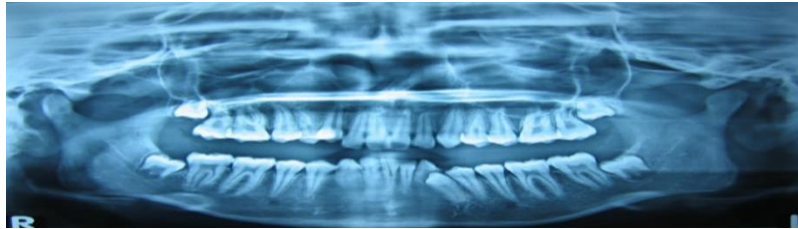


Fig 4: This O.P.G. of 14 years old subject shows third molar in 'E' 'E' 'E' 'E' stages of development in relation to 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.

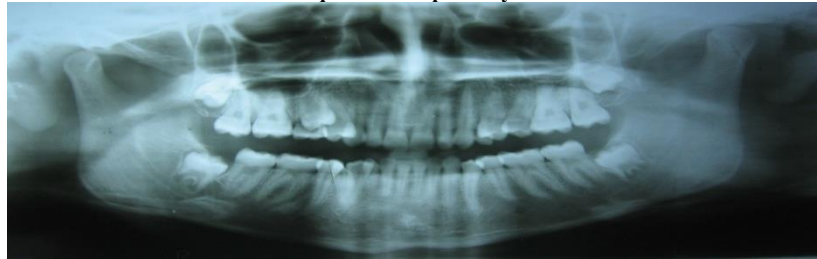


Fig 5: This O.P.G. of 16 years old subject shows third molar in 'F' 'F' 'F' 'F' stages of development in relation to 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.

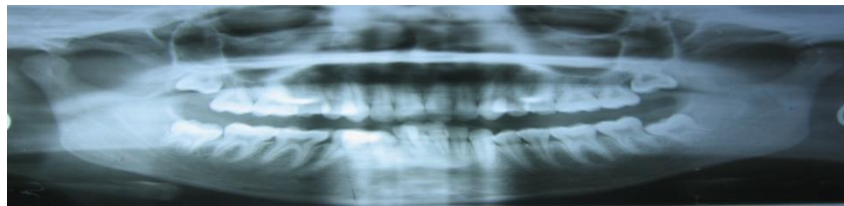


Fig 6: This O.P.G. of 18 years old subject shows third molar in 'G' 'G' 'G' 'G' stages of development in relation to 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.

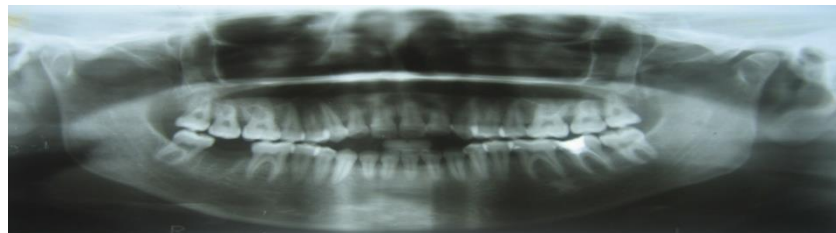


Fig 7: This O.P.G. of 23 years old subject shows third molar in 'H' 'H' 'H' 'H' stages of development in relation to 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quadrant respectively.

**Inclusion criteria:**

1. Age of the patient was between 14 to 25 years.
2. At least 1 third molar was present.
3. North Indian patients were included

**Exclusion criteria:**

1. All third molars were absent.
2. Pathology presented in relation to third molar.
3. Fractured third molar or fractured mandible and/or maxilla with fracture line going through third molar.
4. History of trauma in relation to mandible and/or maxilla.

**Results**

The results are shown in the table 2. Mean age and standard deviation corresponding of each stage were obtained. Stages A and B was not present in the age interval examined (14 to 25 years). Age related to stage C was below 18 years and age related to stage H was above 18 years.

**Table 2: The third molar stages and mean age corresponding to every stage.**

3 <sup>rd</sup> molar Stage	Number of teeth	Mean Age (years)	Standard Deviation
C	24	15.25	1.42
D	69	15.87	2.59
E	50	16.5	2.76

F	57	19.11	2.97
G	52	19.56	2.73
H	119	21.29	2.14
Total	371		

### Discussion

The single compelling reason to rely on third molar formation to estimate chronological age is that there are very few alternative methods during the interval roughly between the late teens and early 20s. All of the other teeth have erupted and completed their root formation[10]. All of the hand-wrist bones have reached their adult morphologies and their epiphyses have fused[11], and the onset of secondary sex characteristics has occurred[12,13]. In consequence, except for the ossification of some early-fusing cranial and postaxial sutures (which are themselves quite variable) [14,15] there are no biological criteria by which to estimate chronological age. Demirjian given a classification distinguishing four stages of crown development (stages A–D) and four stages of root development (stages E–H) of teeth. This system avoids any numeric identification of stages so as not to suggest that the different stages represent processes of the same duration. The stages observed by these authors were defined by changes of shape and independent of estimations of length[8]. Dhanjal et al investigated the reproducibility of different radiographic stage assessment of third molars and concluded that the method of stage assessment of teeth developed by Demirjian et al performed best not only for intra- and inter-examiner agreement, but also for the correlation between estimated and true biological age[16]. Third-molar development among the north Indian population examined was found to occur at an advanced age relative to other populations,[17] so in this study only north Indian patients were included to avoid region specific variations.

In this study, according to table 2, development of 3<sup>rd</sup> molar was seen at-

Stage 'C' in the mean age of 15.25 years and in the range of 13.83 to 16.67

Stage 'D' in the mean age of 15.87 years and in the range of 13.28 to 18.46

Stage 'E' in the mean age of 16.5 years and in the range of 13.74 to 19.26

Stage 'F' in the mean age of 19.11 years and in the range of 16.14 to 22.08

Stage 'G' in the mean age of 19.56 years and in the range of 16.83 to 22.29

Stage 'H' in the mean age of 21.33 years and in the range of 19.1 to 23.5

These results clearly so that at stage C, a person will probably be below 18 years (minor) and at stage H an individual will probably be above 18 years (major).

Reason for result in a wide and overlapping age ranges might be because of-

1. Sample size was small. For more accurate results a large sample study is needed.

2. All stages was a continuous phenomenon so accurate demarcation between two stages was difficult.

3. Because of deviated position of tooth in bone a clear picture of tooth in OPG radiograph was not visible, so accurate estimation of stage was quite difficult in that case.

4. People from different territory might showed differences in timings of development of stages of third molar.

**Conflict of Interest: Nil**

**Source of support: Nil**

### Conclusion

The stages of third molar development can be reliably used to estimate the chronological age of an individual in his late teens to early twenties. At stage H an individual is probably be above 18 years depicting third molar root completion and at stage C an individual is probably below 18 years of age depicting third molar crown in developing position. So, in living individual, third molar maturity is the best age estimation method as it is non-invasive and usable dental images are easily obtained.

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