A Comparative Study on Emergence Pattern of Permanent Teeth among four Communities of Nepal

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INTRODUCTION: Emergence of the tooth, in simpler term is (means) the appearance of tooth in oral cavity through the gingiva. Emergence of permanent teeth has been studied among different population and among different ethnic groups. Standards for tooth emergence should be derived from the population in which they are to be applied because factors related to tooth emergence of both deciduous and permanent dentitions may vary among various races.

METHODOLOGY: The clinical dental examination of the children was carried out in Brahmin, Chhetri, Rai and Limbu communities residing in Sunsari district of Eastern Nepal. A total of eight hundred fifty seven healthy children of pure races were included in the study. Children were grouped age, sex and community wise. The following age groups were considered: 3.5-5years, 6.5-8years, 9.5-11years and 15-16 years.

RESULTS: The study result shows that the permanent teeth emerge and mature earlier in Rai and Limbu compared to Brahmin and Chhetri.

CONCLUSION: Our present study concludes that there is racial variation in emergence pattern of permanent teeth and there is need to conduct study on children of each and every ethnic communities.

KEYWORDS: Emergence, permanent teeth, dentition, communities.


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INTRODUCTION

Emergence of the tooth, in simpler term is (means) the appearance of tooth in oral cavity through the gingiva. Emergence of permanent teeth has been studied among different population and among different ethnic groups like Muniz conducted study in Argentinean children1, Eskeli et al. in Finish children2, pakhala et al. in northeastern Finland3, Jaswal in khasi children of India4, Garcia-Godoy F et al. in southeastern Dominican school5, Brown T in Australian children6, Koyoundjisky-kaye E et al. in Israeli children7, Diamanti J et al. in Australian children8, sharma K et al. in Gujjar children of india9, Mayhall JT et al. in Canadian Eskimos10, Mugonzibwa EA et al. in Tanzanian children11. Information on the permanent teeth emergence used in clinical and academic situation in Nepal is based on American and European standards. Standards for tooth emergence should be derived from the population in which they are to be applied because factors related to tooth emergence of both deciduous and permanent dentitions may vary among various races12. Therefore adequate knowledge of the timing of emergence of permanent teeth among Nepalese children is required for diagnosis and treatment plan.

MATERIALS AND METHODS

The clinical dental examination of the children was carried out in Brahmin, Chhetri, Rai and Limbu communities residing in Sunsari district of Eastern Nepal from January
2012 to November 2012. A total of eight hundred fifty seven healthy children of pure races were included in the study. Children were grouped age, sex and community wise. The following age groups were considered: 3.5-5 years, 6.5-8 years, 9.5-11 years and 15-16 years. Healthy children are defined as those without any growth related disorders, any genetic abnormalities having no prolonged disease like diabetes mellitus, endocrine disorders, cardiac, renal and intestinal disorders. Pure race means no intermingling i.e. children whose parents and grandparents did not make intercaste marriage. The data covered all urban and rural children of high, medium and low economic status. Data was collected from community including those attending dental camps, school children in their schools and attendants of patients coming to the pedodontic department of college of dental surgery. Age of the patient was recorded by birth certificates or looking at birth register in school. But incase of children attending dental camps or clinics age of the child was asked to his/her parent. Due informed consent was obtained from guardians of subjects. All participants understood and spoke nepali language and informed consent was taken in nepali language. They were healthy and from pure ethnic races of Brahmin, Chhetri, Rai and Limbu. Ethical clearance was obtained from Institutional ethical committee. In dental pedodontic OPD the subjects were seated on dental chair and examination of oral cavity was done under the dental chair right with the help of mouth mirror. In case of dental camps and schools, subjects were seated on wooden chair and examination was done under torchlight and with the help of mouth mirror.

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Rai Boys</th>
<th>Girls</th>
<th>Limbu Boys</th>
<th>Girls</th>
<th>Chhetri Boys</th>
<th>Girls</th>
<th>Brahmin Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5-5yrs</td>
<td>31</td>
<td>31</td>
<td>32</td>
<td>32</td>
<td>31</td>
<td>32</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>6.5-8yrs</td>
<td>24</td>
<td>23</td>
<td>21</td>
<td>30</td>
<td>29</td>
<td>29</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>9.5-11yrs</td>
<td>21</td>
<td>23</td>
<td>30</td>
<td>25</td>
<td>27</td>
<td>26</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>15-16yrs</td>
<td>30</td>
<td>25</td>
<td>27</td>
<td>27</td>
<td>25</td>
<td>25</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>102</td>
<td>110</td>
<td>114</td>
<td>112</td>
<td>112</td>
<td>101</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maxilla Left Side</th>
<th>Maxilla Right Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI</td>
<td>63.0</td>
</tr>
<tr>
<td>L1</td>
<td>60.4</td>
</tr>
<tr>
<td>C</td>
<td>47.4</td>
</tr>
<tr>
<td>PM1</td>
<td>47.6</td>
</tr>
<tr>
<td>PM2</td>
<td>48.3</td>
</tr>
<tr>
<td>M1</td>
<td>69.0</td>
</tr>
<tr>
<td>M2</td>
<td>45.9</td>
</tr>
<tr>
<td>Mandible Left side</td>
<td>Mandible Right side</td>
</tr>
<tr>
<td>CI</td>
<td>64.9</td>
</tr>
<tr>
<td>L1</td>
<td>62.5</td>
</tr>
<tr>
<td>C</td>
<td>59.9</td>
</tr>
<tr>
<td>PM1</td>
<td>49.9</td>
</tr>
<tr>
<td>PM2</td>
<td>49.2</td>
</tr>
<tr>
<td>M1</td>
<td>69.3</td>
</tr>
<tr>
<td>M2</td>
<td>46.6</td>
</tr>
</tbody>
</table>

Table 1. Distribution of subjects age, sex and community wise.
Emergence of tooth can be defined as the appearance of tooth in oral cavity through gingiva. The stages of emergence of the permanent teeth were determined by classifying the emergence of each tooth into following four stages:

0= tooth not visible in the oral cavity.
1= at least one cusp visible in oral cavity.
2= entire occlusal surface/mesio-distal width of the tooth visible.
3= tooth in occlusion or at the occlusal level if antagonistic tooth is not fully erupted.

**Statistical Design and Analysis**

This was a cross sectional study. Multistage random sampling technique was adopted. It is multi stage because research subjects are grouped into four communities like Brahmin, Chhetri, Rai and Limbu. In each community they are grouped into male and female. In each gender they are grouped into four age groups like 3.5-5 years, 6.5-8 years, 9.5-11 years, 15-16 years. It is random sampling because research subjects were selected randomly. The collected data was entered in computer using Microsoft windows access software. Analysis was done using SPSS (statistical package for social sciences) version 10:00 software. Student “t” test were used to test the significance of the variables depending upon the nature of data collected.

**RESULTS**

Eight hundred and fifty seven children were taken into the study of the permanent teeth. 0.1% teeth were extracted due to dental caries. Such children with history of teeth extraction were also excluded.

No statistically significant difference was detected in the emergence pattern of the permanent teeth between the right and left side as seen in Table 2, (Student paired ‘t’ test was applied to test the significance because there was comparison of two means of right and left side with small standard deviation) and therefore, the left side was selected arbitrarily for the study analysis though study was carried out on both sides hence emergence pattern of the teeth in the left side of the maxilla and mandible are reported.

**Emergence Stages**

0= tooth not visible in the oral cavity
1= at least one cusp visible in oral cavity.
2= entire occlusal surface/mesio-distal width of the tooth visible.

**Table 3.** Distribution (in percentage) of subjects with at least one emerged permanent tooth according to emergence stages and age group of 3.5-5years. (n=249).

<table>
<thead>
<tr>
<th>Communities</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rai</td>
<td>*83</td>
<td>8.5</td>
<td>5</td>
<td>3.5</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Limbu</td>
<td>*84</td>
<td>9</td>
<td>5.5</td>
<td>1.5</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brahmin</td>
<td>*96</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chhetri</td>
<td>95</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(*p<0.05).

**Table 4.** Distribution (in percentage) of subjects with at least one emerged permanent tooth according to emergence stages and age groups of 6.5-8years. (n=204).

<table>
<thead>
<tr>
<th>Communities</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rai</td>
<td>0</td>
<td>0</td>
<td>0.5</td>
<td>99.5</td>
<td>*81</td>
<td>9</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Limbu</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>97</td>
<td>*80</td>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Brahmin</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>93</td>
<td>*92</td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chhetri</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>96</td>
<td>87</td>
<td>7</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

(*p<0.05).
Table 5. Distribution (in percentages) of subjects with at least one emerged permanent tooth according to emergence stages and age groups of 9.5-11 years. (n=198).

<table>
<thead>
<tr>
<th>Communities</th>
<th>Emergence Stages</th>
<th>First Transitional Period</th>
<th>Second Transitional Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rai</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Limbu</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brahmin</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chhetri</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(*p<0.05).

Table 6. Distribution (in percentage) of subjects with at least one emerged permanent tooth according to emergence stages and age groups of 15-16 years. (n=206).

<table>
<thead>
<tr>
<th>Communities</th>
<th>Emergence Stages</th>
<th>First Transitional Period</th>
<th>Second Transitional Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rai</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Limbu</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brahmin</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chhetri</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

3= tooth in occlusion or at the occlusal level if antagonistic tooth is not fully erupted.

Teeth in the first transitional period: M1, CI, LI and in the second transitional period:
C, PM1, PM2, and M2.

Table 3 shows there is significant difference (p<0.05) with score zero between Rai and Brahmin, Rai and Chhetri, Limbu and Brahmin and Limbu and Chhetri but no significant differences (p>0.05) between Rai and Limbu and Brahmin and Chhetri. 83% of Rai and 84% Limbu and 96% of Brahmin and 5% Chhetri having zero score in first transitional period (Transitional period is the period between the completion of eruption of primary dentition and the emergence of the permanent teeth. In the first transitional period there is emergence of first permanent molars(M1), central and lateral incisors(CI & LI) and in the second transition period there is emergence of Permanent canines(C), first and second premolars(PM1 & PM2) and second molars(M2)) at age of 3.5-3.5 years age, suggest that the permanent teeth emerge earlier in Rai and Limbu compared to Brahmin and Chhetri. There is no significant difference with score 1 and 2

**Emergence Stages**

0= tooth not visible in the oral cavity
1= at least one cusp visible in oral cavity.
2= entire occlusal surface/mesio-distal width of the tooth visible.
3= tooth in occlusion or at the occlusal level if antagonistic tooth is not fully erupted.

Teeth in the first transitional period: M1, CI, LI and in the second transitional period:
C, PM1, PM2, and M2.

Table 4 shows less percentage of Rai (81%) and Limbu (80%) and greater percentage of Brahmin (92%) having zero score suggest that the permanent teeth emerged earlier in second transitional period at the age groups of 6.5-8 years in Rai and Limbu compared to Brahmin. There is significant difference (p<0.05) with score zero between Rai and Brahmin, Limbu and Brahmin but no significant difference between Chhetri and other communities as well as Rai and Limbu. There is no significant difference with other scores as well.

**Emergence Stages**

0= tooth not visible in the oral cavity
1= at least one cusp visible in oral cavity.
2= entire occlusal surface/mesio-distal width of the tooth visible.
3= tooth in occlusion or at the occlusal level if antagonistic tooth is not fully erupted.

Teeth in the first transitional period: M1, CI, LI and in the second transition period:
C, PM1, PM2, and M2.

Table 5 shows there is significant difference (p<0.05) with score 3 in between Rai and Brahmin, Rai and Chhetri as well as Limbu and Brahmin. Greater percentage of Rai (79%) and Limbu(78%) with score 3 compared to Brahmin(67%) and Chhetri (68%)suggest that permanent teeth matures earlier in Rai and Limbu as compared to that in Chhetri and Brahmin. There is no significant difference with scores 0,1,2.

**Emergence Stages**

0= tooth not visible in the oral cavity
1= at least one cusp visible in oral cavity.
2= entire occlusal surface/meso-distal width of the tooth visible.
3= tooth in occlusion or at the occlusal level if antagonistic tooth is not fully erupted.

Teeth in the first transitional period: M1, CI, LI and in the second transition period:
C, PM1, PM2, and M2.

Table 6 shows there is no significant difference among the communites with any scores. It suggest that all permanent teeth except third molar have got already emerged into oral cavity by 15-16years in all communities.

Table 7 shows the mean age of teeth for score 1 in the four communities. The result shows the sequence of emergence of teeth is similar in all four communities i.e. for maxilla:- first molar, central incisor, lateral incisor, first premolar, second premolar, canine and second molar and for mandible:- first molar, central incisor, lateral incisor, canine, first premolar, second premolar and second molar.

**DISCUSSION**

Timing of emergence of teeth varies in different population. Presently there is an increased tendency to study and compare the emergence pattern and timing of teeth in different regions of world. It is important to have a standard record of emergence of teeth pattern as it affects treatment plan. Most studies on emergence of the permanent teeth have shown that an emerged tooth was present when at least part of the incisal edge or cusp of the permanent tooth was visible in the oral cavity13,14,15,16 except Pahkala R et al.3 who also considered the later emergence stages based on clinical determination suitable for epidemiological studies. Radiographic methodology to determine developmental stages of the dentition may not be feasible in developing countries and not be allowed in community based studies for ethical reasons in either developing or developed countries17,18,19.

In our study it was not found significant difference between right and left side in emergence of permanent teeth (Table 2). It agrees to findings of Kochhar R et al.20, Krumholt L etal21, Friedlaender JS et al.22, Billewicz WZ et al.14, Pahkala R et al.3.

In the present study it was found that permanent teeth emerged earlier in Rai and Limbu compare to Brahmin and Chhetri in first transitional period (see Table 3) and in second transitional period (Tables 4 and 5). In the present study it was also found that mandibular teeth emerged earlier than the maxillary counterpart in all community (Table 7). This agrees to findings of Kochhar R et al.20.

Regarding the sequence of emergence of teeth, similar sequence was found in all four communities (Table 7). The sequence for maxilla was first molar, central incisor, lateral incisor, first premolar, second premolar, canine and second molar and for mandible: first molar, central incisor, lateral incisor, canine, first premolar, second premolar and second molar. This finding is in line with findings of Jaswal S4.

Mugonzibwa EA et al. studied on Tanzanian children regarding emergence of permanent teeth and found that permanent teeth in Tanzanian children clearly emerged earlier than in Caucasions children11. Muniz B in Argentina found no differences in mean times of emergence of permanent teeth between the two ethnic groups (Caucasion vs. Amerindian). Eskeli R et al. who conducted study in Finnish children in Eastern and Western part of the country found no regional variation in emergence of teeth2. Pahkala R et al. observed that earlier eruption of the permanent teeth
in rural children in north eastern Finland than in other parts of the country. Jaswal S found that khasi children showed early emergence of teeth who compared to other population. Garcia-Goddy F et al. found advanced timing of permanent tooth emergence in southeastern Dominican school children population when compared with those of United States whites and blacks, Danish, Canadian Eskimos, French-Canadians etc. Brown T found that aboriginal Australian children displayed earlier emergence of most teeth than that other non-European populations. Genetic differences also contribute to earlier emergence of teeth. Koyoundjijsky-kaye E et al. found that some teeth like maxillary and mandibular incisors and canines erupt somewhat later in Israeli children compared to population of other parts of the world. While comparing the emergence pattern and time among males and females in the present study no significant difference was observed. However Diamanti J et al. observed in Australian children that tooth emergence was advanced in girls compared with boys averaging 4.5 months in maxilla and 3.5 months in mandible. Sharma k et al. in their cross sectional study in Gujar children, Muniz B in Argentina, Mayhall JT et al. in their study of Canadian Eskimas and Koyoundjijsky-Kaye E’ found that females were markedly advanced in permanent tooth emergence time over males. Kochhar R et al. observed that females tended to erupt teeth before males with the exception of the 2nd molars in both arches; however the only differences to reach statistical significance related to upper and over canines and upper lateral incisors.

Khan N studied the eruption time of Pakistani children and compared with other nationalities and he concluded that eruption time of Pakistani children are different in many aspects with other nationalities. In another way of emergence of teeth study, Khan et al. revealed 38.5 -39.4% of Saudi female children can be accurately estimated within ±0.5 yr. Mandibular left canine showed lowest mean eruption time while maxillary left second molar showed highest mean eruption time. Mandibular teeth erupted before their maxillary counterparts as revealed by Khan et al. Choihan AN et al. study supported the fact that emergence time varies in different ethnicities. The Saudi female primary school children showed later eruptions time of permanent first molars, central and lateral incisors when compared with the reported results of other national studies.

Fatih Oznurhan et al. studied time and sequence of eruption of permanent teeth in Ankara, Turkey. It was found that eruption tended to be earlier in girls than boys and eruption times show differences which are affected by genetics, gender, ethnicity, nutrition etc. Ritva Eskeli et al. study on secular trends affecting emergence of teeth showed permanent teeth of first phase of mixed dentition erupted earlier in group 2000 than in group 1980 but the teeth of 2nd phase of the mixed dentition erupted later in group 2000.

CONCLUSION

Our present study concludes that there is racial variation in emergence pattern of permanent teeth and there is need to conduct study on children of each and every ethnic communities.

AUTHORS CONTRIBUTION

Dr. P Baral have worked on the concept and the design of the study.

Dr. S. Bhattacharya supervised the data collection, thesis write up and reviewed the article.

Dr. SS Hiremath supervised the data collection, thesis write up and reviewed the article.

Dr. SR Nirula supervised methods of the data collection (sampling method), data entry and data analysis as well as reviewed the article.

Dr. D Banstola edited and proof read the article.

DISCLOSURE

Declared none.

REFERENCES


