ABSTRACT

Midline diastema is a space between maxillary central incisors. The incidence of midline diastema varies greatly with age group, gender, population and race.

**Aim:** To find the occurrence of midline diastema among children of different racial group, visiting outpatient department of Pedodontics and Preventive Dentistry, BPKIHS Dharan, Nepal.

**Materials and methods:** A cross sectional study was done among 900 children of age (1-14) years visiting outpatient department of pedodontics and preventive dentistry, BPKIHS, Dharan, Nepal. Measurement of both maxillary and mandibular midline diastema was made between the midpoints of the mesial surfaces of both central incisors using varnier calliper. Only the diastema greater than 0.5mm was determined and recorded according to age, race and sex.

**Results:** Maxillary midline diastema was seen among 26.6% of children, mandibular diastema among 1% of children, and 1.6% have midline diastema seen together both in maxilla and mandible. 16.6% of male, 10.0% of female had maxillary midline diastema, 0.7% of male and 0.3% of female had mandibular midline diastema and 0.7% of male and 0.9% of female had midline diastema seen together both in maxilla and mandible. Racial significance was seen only at age 6 and 12 years, where Aryan children were more prevalent to midline diastema than Mongoloid children. Children at age 10, 8 and 9 years have more midline diastema with statistical significance of p<0.000. Midline diastema was more prevalent among 6-12 years children in both maxilla and mandible among both racial groups.

**Conclusion:** Midline diastema was more prevalent in mixed dentition period between age 6-12 years. Males were more prevalent for midline diastema than female among Nepalese children.

**Key words:** Midline diastema, Nepalese children
INTRODUCTION:

A diastema is defined as a space greater than 0.5 millimeter between the proximal surfaces of adjacent teeth. Stedman’s Medical Dictionary defines diastema as a “natural space between two succeeding teeth or an interval between teeth, not occurring naturally in man”. Midline diastema is a space (or gap) between maxillary central incisors. True midline diastema has been defined as the one without periodontal/periapical involvement and with the presence of all anterior teeth in the arch. Angles defined midline diastema as a somewhat common form of malocclusion distinguished by a space between the upper central incisors and occasionally though very rarely between lower central incisors. The space varies in width with the diastema being from one to four and sometimes five millimetres wide, always presenting an unpleasant appearance and interfering with speech in proportion to its width.

The incidence of midline diastema varies greatly with the age-group, gender, population and race. This condition is very common in the paediatric age-group at the early stages of dental development. Naturally, after the eruption of the permanent teeth, the gap closes in majority of them. However, where the diastema remains after the eruption of the permanent incisors and canine, such may not close on its own. The so called “ugly duckling stage was described by Broadbent as a normal developmental phenomenon. Erupting central incisors show an initial transitory diastema which is subsequently closed with eruption of lateral incisors and canines. The ugly duckling should not be confused with malocclusion.

Different factors contribute to the occurrence of diastema. Racial and Gender differences also exist for diastema. It could be by the action of a superior labial frenum, causing high mucosal attachment and less attached keratinised tissue which is more prone to recession, or by tongue thrusting, which can push the teeth apart. Lip biting, missing teeth, size mismatch between teeth and jaws, or abnormal jaw bone structure, are also possible factors implicated in the formation of diastema. A possible genetic basis has been suggested for diastema, with a greater role of environmental factors in the Black than the White population. Weber listed the causes for spacing between the maxillary incisors as a result of high frenum attachment; microdontia; macrognathia; supernumerary teeth; peg laterals; missing lateral incisors; midline cysts and habits such as thumb sucking, mouth-breathing and tongue-thrusting.

Researchers and clinicians now believe that multiple factors may contribute to a midline space including oral habits, soft tissue imbalances, physical impediments, dental anomalies and/or dental/skeletal disharmonies as well as normal dento alveolar development as proposed by Becker, Edwards, Steigman, Clark, Bishara, and Campbell.

There are scant data on midline diastema among Nepalese children. The purpose of the present cross sectional study was to describe the occurrence of midline diastema among the children.
of different age (1-14 years), gender and racial group visiting Department of Pedodontics and Preventive Dentistry, BP Koirala Institute of Health Sciences, Dharan, Nepal.

MATERIALS AND METHODS:

This was a cross-sectional study done using convenience sample of 900 children belonging to two ethnic group Mongoloid (Tibeto-Burman) which includes, Rai, Limbu, Sherpa, Tamang, Gurung, Magar, Newar, Thakali, Chepang, Jirel and Thami) and Aryan (Indo-Aryans) which includes, Brahmin, Chhetri, Kami, Damai, Majhi, Darai, Kumhal, Danuwar, Rajbansi, Yadav, Mehta, Satar and Gupta, attending the out Patient Department of Pedodontics and Preventive Dentistry, BPKIHS Dharan, Nepal. Ethical clearance was taken from Institutional Ethical Committe BPKIHS, Dharan. Written informed consent was obtained from all parents/ guardians before commencement of the study.

Patient with no history of previous or present orthodontic treatment, no obvious dental or dento facial abnormalities were included whereas patient on/history of orthodontic therapy, hypodontia of maxillary and mandibular incisors, cleft palate /cleft lip or other congenital deformities of jaws or face and with Oro facial syndromes, missing one or both central incisors, patients who had suffered a trauma involving injuries to the mucosa of the maxillary and mandibular incisor region were excluded.

All examination was carried out in the dental chair under adequate light by the same examiner. The examination consisted of an overall evaluation of the oral condition using mouth mirror. Measurement of both maxillary and mandibular midline diastema was made. Only the diastema greater than 0.5mm was determined by measuring the distance between the midpoints of the mesial surfaces of both central incisors using vernier caliper. The measurements were recorded according to age, race and sex. Children were divided into 3 groups, Group I: children 1-6 years. Group II: children >6 years till 12 years. Group III: children greater than 12 till 14 years.

STATISTICAL ANALYSIS

All the data were entered in Microsoft excel and analyzed using SPSS package (version 12). All the data were presented as frequency and percentages. Chi square test was used to analyze and compare midline diastema in maxilla and mandible aming children of different age, sex and race. The level of significance was P<0.05.
RESULTS:
Among 900 children, 297 belonged to group I, 467 belonged to group II and 136 belonged to group III. 506 children examined were male and 394 female. Among 2 racial groups, 511 belonged to mongoloid race and 389 belonged to Aryan race. Of 900 children examined, maxillary midline diastema was present among 26.6% of children, mandibular midline diastema among 1% of children and 1.6% have midline diastema present together both in maxilla and mandible with p<0.000 (Table I). Among 26.6% of children with maxillary midline diastema, 16.6% were male (n=149), 10.0% (n=90) were female. Among 1% of children with mandibular midline diastema, 0.7% were male and 0.3% were female. Among 1.6% of children with midline diastema seen together both in maxilla and mandible, 0.7% were male and 0.9% were female (Table II). Males were more prevalent for midline diastema in both maxilla and mandible.

Table I: Percentage of Midline Diastema

<table>
<thead>
<tr>
<th>Types of Diastema</th>
<th>Maxillary midline (%)</th>
<th>Mandibular midline (%)</th>
<th>Coexisting maxillary and mandibular midline (%)</th>
<th>Total (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.6% (239)</td>
<td>1.0% (9)</td>
<td>1.6% (14)</td>
<td></td>
<td>29.2%</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table II: Percentage of diastema among males and females

<table>
<thead>
<tr>
<th>Types</th>
<th>Female (%)</th>
<th>Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary midline</td>
<td>90 (10.0%)</td>
<td>16.6% (149)</td>
</tr>
<tr>
<td>Mandibular midline</td>
<td>3 (0.3%)</td>
<td>6 (0.7%)</td>
</tr>
<tr>
<td>Both</td>
<td>8 (0.9%)</td>
<td>6 (0.7%)</td>
</tr>
</tbody>
</table>

Comparing separately among children of different age group, 4.9% of Group I, 18.9% of Group II and 2.8% of Group III children had maxillary midline diastema. 0.2% of Group I, 0.8% of Group II had mandibular midline diastema. 0.1% of Group I, 1.4% of Group II had midline diastema seen together both in maxilla and mandible. This was of statistical significance p<0.000. (Table III, Figure I)

Figure I: Midline diastema in maxilla
Table III: Percentage of midline diastema at different age group.

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Maxilla</th>
<th>Mandible</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>44 (4.9%)</td>
<td>2 (0.2%)</td>
<td>1 (0.1%)</td>
</tr>
<tr>
<td>Group II</td>
<td>170 (18.9%)</td>
<td>7 (0.8%)</td>
<td>13 (1.4%)</td>
</tr>
<tr>
<td>Group III</td>
<td>25 (2.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>239 (26.6%)</td>
<td>9 (1.0%)</td>
<td>14 (1.6%)</td>
</tr>
</tbody>
</table>

P value 0.000

Among Group I children, 8.8% of mongoloid male, 5.3% of mongoloid female and 9.4% of Aryan male and 6.3% of Aryan female had maxillary midline diastema. Among Group II children, 23.6% of mongoloid male, 11.1% of mongoloid female and 24.7% of Aryan male, 14.4% of Aryan female had midline diastema (p<0.000). Among children of Group III 2.9% of mongoloid male, 4.3% of mongoloid female and 12.1% of Aryan male and 18.2% of Aryan female had maxillary midline diastema. Statistical significance was seen only among Aryan male and female of group II children. (Table IV)

Table IV: Percentage of diastema among different age group and race.

<table>
<thead>
<tr>
<th>Age</th>
<th>Maxilla</th>
<th>Mandible</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>Mongoloid</td>
<td>24 (14.1%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Aryan</td>
<td>20 (15.7%)</td>
<td>2 (1.6%)</td>
</tr>
<tr>
<td>Group II</td>
<td>Mongoloid</td>
<td>94 (34.7%)</td>
<td>6 (2.2%)</td>
</tr>
<tr>
<td></td>
<td>Aryan</td>
<td>76 (39.2%)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Group III</td>
<td>Mongoloid</td>
<td>5 (7.1%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Aryan</td>
<td>30.3%</td>
<td>0</td>
</tr>
</tbody>
</table>

Comparing separately among children of different age, 3.4% of age 6, 3.1% of age 7, 6.4% of age 8 years, 5.6% of age 9, 6.6% of age 10 years, 2.6% of age 11, 1.7% of age 12, 0.6% of age 13 and 1.3% of children of age 14 years had maxillary midline diastema. Higher percentage of midline diastema was seen among children of age group 10 years, followed by 8 years then 9 years with statistical significance of p<0.000. Children at this age were more prevalent for midline diastema. (Table V, Figure II).
On comparison between 2 racial groups (Mongoloid and Aryan) at age 6 years, 15.2% of Aryan and 9.1% of mongoloid children had maxillary midline diastema (P<0.041). So, Aryan children at this age were more prone for midline diastema than mongoloids. Among 7 years, 10.3% of mongoloids and 8.6% of Aryans had maxillary midline diastema P<0.212. Among 8 years, 21.1% of mongoloid and 20.2% of Aryan children had maxillary midline diastema p<0.739. Among 9 years, 20.0% of Aryan children and 19% of mongoloid children had maxillary midline diastema P<0.265. Among 10 years, 34.1% of mongoloid children and 20.0% of Aryan children had maxillary midline diastema. P<0.374. Among 11 years, 19.3% of mongoloid and 12.3% of Aryan children had maxillary midline diastema. P<0.395. Among 12 years, 18.2% of Aryan and 3.6% of Mongoloid children had
maxillary midline diastema $P<0.016$. Aryan children at this age were more prone for maxillary midline diastema when compared to mongoloid children. Among 13 years, 4.8% of both Aryan and Mongoloid children had maxillary midline diastema. Among 14 years, 20.5% of Aryan and 2.6% of Mongoloid children had maxillary midline diastema ($P<0.77$). (Figure III, IV, V)

**Figure III:** Maxillary midline diastema (statistical Significance*) among two racial group at different age.

**Figure IV:** Midline diastema at different age and sex in maxilla, mandible and together both in maxilla and mandible among Aryans and mongoloid children

**Figure V:** Maxillary Midline Diastema at different age
DISCUSSION:

A diastema between the maxillary central incisors is a relatively common finding during the deciduous and mixed dentition. The majority of these close spontaneously by the time maxillary canine appear, but a few persist into mature permanent dentition. Several factors can cause a diastema that may require intervention. An enlarged labial frenum has been blamed for persistent diastema, but its etiologic role now is understood to represent only a small proportion of cases. Other aetiologies associated with diastema include oral habits, muscular imbalances, physical impediments, abnormal maxillary arch structure and various dental anomalies.

In this study, maxillary midline diastema was seen among 26.6% of children, mandibular diastema among 1% of children, and 1.6% have midline diastema present together both in maxilla and mandible. Among 26.6% of children with maxillary midline diastema, 16.6% were male (n=149), 10.0% (n=90) were female, 0.7% of male and 0.3% of female had mandibular midline diastema. A male is more likely to have both maxillary and mandibular diastema in this study. Gabriel et al in their study on midline diastema amongst south western Nigerians found the incidence of midline diastema to be 26.1% and also better appreciated among females (50.6%) than in males (4.1%). A female is more likely to have a maxillary midline diastema (65.3% females: 34.7% males) while a male is more likely to have mandibular midline diastema (9.1% females: 90.9% males).

Harris J Keene in their study on distribution of Diastema in the dentition of man mentioned that diastema were almost exclusively located in the anterior region of the dentition. Two third of the spaces were found in the pre and post canine areas of the maxilla and mandible. Seventy five percent of diastema occurred in the maxilla, 25% occurred in mandible. Nainar and Gnasasundaram studied nearly 9774 patients in the age group of 13-35 years in South India (Chennai) and reported an incidence of true maxillary midline diastema (1.6%), which was greater than that of true mandibular midline diastema (0.3%). In this study, the incidence of maxillary midline diastema (26.6%) was greater than that of mandible (1%). Kaimenyi determined the prevalence of midline diastema and frenum attachments among school children (4-16 years) in Nairobi, Kenya. They found, the maxilla had a higher prevalence of midline diastema than the mandible. Master luqman et al in their study on the prevalence and etiology of maxillary midline diastema in a Saudi population found higher prevalence of midline diastema among male (25%) compared to female (14%). This finding was similar to our study. Lagravere et al in their study found large midline diastema among infants which decreased with age. In this study, 4.9% of 1-6 years old children had midline diastema which was less than the 6-12 years old children but more than 12-14 year old children.

According to epidemiologic investigations in England by Taylor (USA), Gardiner (England) and Weyman (British), the prevalence of midline diastema is high among young children. Taylor found that 97% of 6 year old children in USA exhibited a maxillary midline diastema. Other studies have shown that incidence was 44% among 6 year old children, 45% among 9 year old and was only 9% among 16 year old children. Gardiner examined 1000 British children and found that 46% of them
had diastema at age 6, 33% at age 9, 18% at age 12 and 12% at age 13. In this study, maxillary midline diastema was seen among 3.4% at age 6, 3.1% at age 7, 6.4% at age 8, 5.6% at age 9, 6.6% at age 10, 2.6% at age 11, 1.7% at age 12, 0.6% at age 13 and 1.3% at age 14 years. Maxillary midline diastema was more among children of age 10, 8 and 9 years. The prevalence of midline diastema was found to be less when compared to these studies.

Richardson and co-workers studied 6-14 years old 5307 children. They found females in both races showed a higher prevalence than males at age 6, however at age 14 males had a higher prevalence in both races. In general, maxillary midline diastema occur in approximately 50% of children between 6-8 years of age but decreases in size and prevalence with age. In this study, male showed the higher prevalence of midline diastema in both maxilla and mandible. Greater prevalence of maxillary midline diastema was seen among Aryan males at all ages except 13 and 14 years where Aryan females were more prevalent and at 10 years where Mongoloid males were more prevalent. In a study, done among Taiwanese children, the prevalence of midline diastema was higher in girls than in boys only at ages 7 and 8, from ages 9 to 12 boys had higher prevalence of diastema. There was significant difference between boys and girls at ages 9 and 12 years. In this study, statistical significance was found only at age 6 and 12 years between two racial groups where Aryan children were more prevalent for maxillary midline diastema than Mongoloid children.

Differences in race were also found to affect the percentage of children who have midline diastema. Lavelle and colleagues reported the prevalence of maxillary midline diastema was greater in African populations than among Caucasians or Asians. Horowitz studied comparable populations of 10-12 year old black and white children and found that 19% of black children exhibited a midline diastema compared to only 8% of the white children. Comparing separately among male and female in two racial group, mongoloid male had more maxillary midline diastema than mongoloid female in all age group except 13 years where midline diastema wasn’t seen. Aryan males were more prevalent at age 6, 7, 8, 11 and 12 years. Aryans female had more midline diastema at age 10, 13 and 14 years. Equal prevalence was seen at age 9 years. Statistical significance was seen only at age 8 years among Aryan male and female and at 7 years among mongoloid male and female. In our study, greater percentage of midline diastema was seen in children at 10 years, 8 years and 9 years, which was statistically significant. Midline diastema was more prevalent among 6-12 years children in both maxilla and mandible in both racial groups.

The frenum could affect the presence and magnitude of the midline diastema if other oral conditions are present (wide maxilla, small teeth, hypodontia, dental caries) but it is not necessarily the most important determining factor. Broadbent's view (1941) concerning midline diastema in the developing dentition as a normal phenomenon in growing children has been supported in large extent in the literature (Gardiner, 1969; Bishara, 1972; Richardson et al., 1973; Huang and Creath, 1995). The presence of midline diastema can be a normal condition that generally disappears after the permanent teeth erupt. Surgical intervention of the labial frenum is not recommended during the
primary dentition and an adequate diagnosis that includes all the possible factors involved is necessary.\textsuperscript{21}

**CONCLUSION:**

Midline diastema is more prevalent in developing dentition, in maxillary arch, when compared to mandibular arch. Nepalese males were more prevalent for midline diastema than females. Children were more prevalent to midline diastema at age 10, 8 and 9 years. Midline diastema is an esthetic issue so; early diagnosis, prevention and interception should be done if needed. Keeping a record of patients diagnosed can help in early intervention and successful treatment planning. Corrective steps should be taken at early stages for young individuals to minimize its frequency.

**ACKNOWLEDGEMENT:**

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