

# Evaluation of Parental Awareness about Association of Premature Loss of Primary Maxillary Anterior Teeth and Speech Changes in Preschool Children: A Survey Study

**Running Title:** This study aimed to evaluate parental awareness about association of premature loss of primary maxillary anterior teeth and speech changes in preschool children.

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**Abstract:** *Purpose:* This study's purpose was to compare Indian parental perceptions about speech changes seen in their children following premature extractions of maxillary primary incisors (PEMPI) and their Awareness regarding role of primary maxillary incisors in proper speech development of the child. *Methods:* Parents of healthy 3 to 6-year-old children, with mild, moderate or severely decayed primary maxillary incisors or had premature extraction done of primary maxillary incisors, were recruited for the study. Those parents were made to take part in a questionnaire survey regarding their perceptions about speech changes in their child following extraction and their awareness regarding role of primary maxillary incisors in the development of proper speech in the child. *Results:* Of 265 patients, only 10 (3.9%) felt their children sounded different following extractions, but contrary to this 28 (11%) reported difficulty with pronunciation of the "s and z" sound, including those parents who did not notice speech changes following extraction, showing that parents were unsure about timings of speech changes. Also parents were asked questions regarding their knowledge and perception regarding role of primary maxillary incisors in development of proper speech, 73 (28.6%) parents were aware of role of upper anterior teeth in development of normal speech. *Conclusion:* In Indian population parents awareness was found to be low regarding association of premature loss of primary maxillary anterior teeth and speech changes.

**Keywords:** Speech Development, premature loss of maxillary primary incisors, Parental perception

## 1. Introduction

Speech is described as an act of producing speech sounds for putting thoughts into words for communication.<sup>1</sup> Speech sounds (phones) are divided into the categories of vowels and consonants with respect to their production in the vocal tract, their acoustic transmission, and their auditory reception. Speech sound disorders include problems with articulation (making sounds) and phonological processes (sound patterns).<sup>2</sup> Phonological disorders implicate a language disorder, whereas articulation disorders imply speech disorders.<sup>3</sup> Phonological disorders involve the linguistic aspect of speech production, which affects multiple speech sounds. On the other hand, articulation disorders involve the motor component of speech and are characterized by incorrect production of the speech sounds.<sup>5</sup> Defective speech may be caused by a variety of factors such as premature loss of teeth, malocclusion, tongue-tie, and cleft lip and/or palate. Out of components necessary for normal speech development, articulation is the one most affected by the

presence or absence of teeth. The teeth serve as useful landmarks for the tongue and play a prominent role during the production of certain speech sounds.<sup>7</sup> The consonant speech sounds categorized as labiodental ([f] and [v]), and alveolar ([n], [t], [d], [s], and [z]) are formed with the aid of the anterior teeth.<sup>8</sup> The articulation of certain consonant sounds, such as v, f, th, s, and z, develops in early childhood and relies heavily particularly on the presence of the maxillary front teeth for pronunciations.

Fant reported that the anterior teeth are the source of sibilance in the "s" sound.<sup>9</sup> This was confirmed by Jensen, who added that the correct "s" sound can be produced with approximation of the incisors toward an edge-to-edge relationship in patients with normal occlusion.<sup>10</sup>

Published literature on the impact of the premature loss of primary maxillary incisors on speech is limited, conflicting and dated. Gable et al.<sup>11</sup> suggested that loss of maxillary incisors in children younger than 5 years old is not likely to result in defective articulation, however,

some investigators have cited slowed or altered speech development as a justification for a replacement if a child has lost a number of teeth early and is just beginning to develop speech.<sup>12</sup>

In India, Hindi remains the most commonly used regional language. In Hindi, various Labio dental consonants are /f/ and Dento-alveolar consonants are /t/, /th/, /d/, /dh/ and /s/, /z/.<sup>13</sup>

Parents are the most important teachers to their child in their early age. Parents who express concerns about their child's appearance may request prostheses to improve self-esteem and enhance socialization with other children, particularly as they prepare for kindergarten. The purpose of this study was to revisit the issue of possible alteration in speech development by investigating existing parental awareness and perceptions about their child's speech when the maxillary primary anterior incisors are lost early. Also, as certain consonants used in Hindi like /f/, /s/ are also commonly used ones in English that require presence of maxillary anterior teeth for their pronunciation, survey was conducted in Hindi as well with mentioning of same consonants.

## 2. Method

This survey study was approved by the Institutional Review Board of Bharati Vidyapeeth Deemed University, Pune. A questionnaire based survey was conducted among parents of children between 2-5 years of age having mild, moderate or severe early childhood caries and premature loss of primary maxillary anterior teeth. Children with speech, learning, developmental, or any type of cognitive delay, those with autism, cleft lip and/or palate, or craniofacial syndromes affecting speech were excluded from participating in the study. Once the patients were identified by doing oral health check-up by visiting nearby Primary and Pre-primary, parents of children were contacted and were invited to participate in the study using a parent information letter. Study consisted of a 260 parents who were given Questionnaire in both English and Regional language(Hindi) in which parents were asked to answer questions about their views on speech changes that occurred in their children following loss or extraction of their primary maxillary incisors. Specifically, questions requested parental assessment of the child having trouble with speech or trouble with speech related to certain sounds or letters like s, v, f, z. Additional questions concerned changes to their child's tongue visibility during

speech and whether the teacher had commented on the child's speech since removal of the incisors. Lastly, set of questions were asked seeking awareness amongst parents regarding role of upper anterior teeth in proper speech development of their child and whether did they consult a Dentist regarding child's speech problem or not. Parents were asked to choose from 3 responses: "No," "Yes" "Not sure".

## 3. Statistical Analysis

Descriptive statistical analyses were carried out in the present study. Results on categorical measurement were presented in number (%).

The Statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data and Microsoft word and Excel were used to generate graphs, tables etc. A summary score was calculated from the parent survey responses, with a "No" response scored as 0, a "Yes" response scored as 1. Positive responses were combined to calculate the overall yes percentages at 95% confidence intervals.

## 4. Results

The interview summary scores (0 for "No" response, 1 for "Yes" response) of parental interviews ranged from 0 to 10.

Results of the responses to the parental interview are displayed in Table 1. The overall yes percentages revealed that 12.5% of parents reported noticing a difference in their child's speech amongst which 3.9% said they observed changes in speech following extraction of teeth, 11% reported their child having trouble with certain letters or sounds like f, v, s and 11% Parents noticed child protruding tongue while speaking and 1% claimed that the teacher had remarked on their child's speech following the removal of the maxillary primary centrals. Speaking about the awareness, 28.6% parents were aware of role of upper anterior teeth in development of normal speech & effect of loss of teeth on speech impairment, suggesting of low awareness. Only 8.6% parents were aware having statistically significant less awareness ( $p < 0.05$ ) about preventive treatment options that avoid development of abnormal speech after loss of upper anterior teeth. But only 0.4% parents visited dentist /dental clinic for their child regarding speech problem incisors.

QUESTIONS	YES n (%)	NO n (%)	Chi- square test	p value, Significance
1. Does child have severe decayed upper front teeth or have lost upper front teeth due to some reason?	78 (30.6 %)	177 (69.4%)	38.435	p < 0.001**
2. Is speech of child normal?	223 (87.5%)	32 (12.5%)	143.063	p < 0.001**
3. Is there any speech change observed following extraction or loss of teeth?	10 (3.9%)	245 (96.1%)	216.56	p < 0.001**
4. Are those speech changes related to specific letters or words like s ,v or f?	28 (11%)	227 (89%)	155.29	p < 0.001**
5. Does your child protrude tongue outside the mouth while speaking?	28 (11%)	227 (89%)	155.29	p < 0.001**
6. Has teacher of child commented on speech of child after removal of upper teeth ?	1 (0.4%)	254 (99.6%)	251.01	p < 0.001**
7. Do you know that upper anterior teeth help in development of normal speech?	73 (28.6%)	182 (71.4%)	46.59	p < 0.001**
8. Are you aware that loss of upper front teeth may lead to speech problems in future?	72 (28.2%)	183 (71.8%)	48.31	p < 0.001**
9. Are you aware of treatment options that avoid development of abnormal speech after loss of upper anterior teeth?	22 (8.6%)	233 (91.4%)	174.59	p < 0.001**
10. Have you ever visited any dentist for your child regarding speech problem?	1 (0.4%)	254 (99.6%)	251.01	p < 0.001**

Figure 1: indicates Questionnaire responses to the parental interview

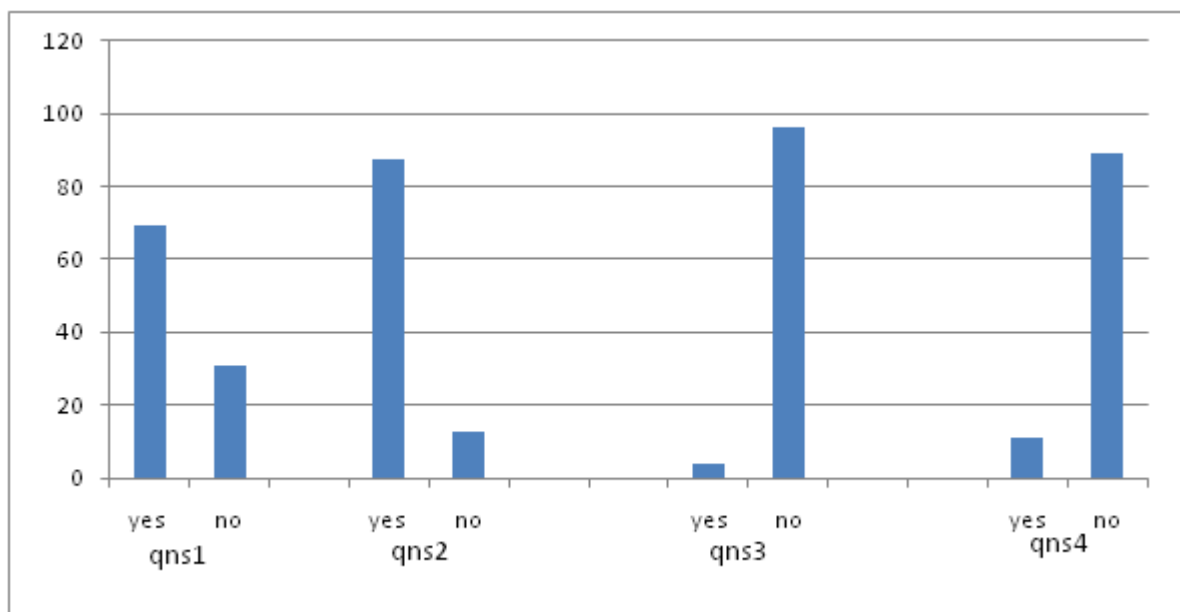
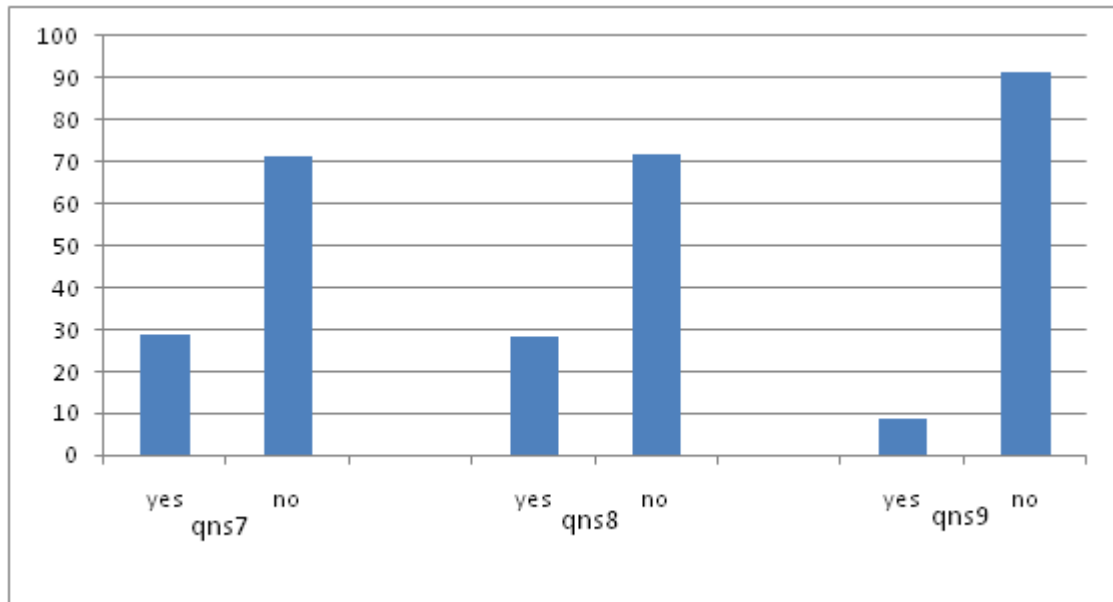


Table 1: indicating bar diagram plot for responses by Parents to questions 1, 2, 3, 4



**Table 2:** indicating bar diagram the Questions that were asked regarding Awareness amongst parents

## 5. Discussion

In the oral cavity, the organs that contribute to speech are the tongue, palate, alveolar processes, gums, lips, and teeth.<sup>14</sup>Of the six components necessary for development of normal speech (respiration, phonation, resonance, articulation, neurologic integration, and audition), articulation is the component most affected by the presence or absence of teeth.<sup>15</sup>

Loss of teeth may be implicated in distortion of the continuant consonants (v, f, th, z, and s) since their correct production necessitates forcing the air stream through an opening in the oral cavity small enough to produce friction noises<sup>16</sup>.

The “s” and “z” sounds, in particular, may be defective since their articulation necessitates developing a narrow air stream against the incisal edges of the anterior teeth.<sup>17</sup>

In India, Hindi remains the most commonly used regional language. It is commonly taught in primary schools of the Indian subcontinent, meaning the number of speakers is likely to increase, depending on population growth. Also, Hindi ranks among the largest of the world’s languages with about three hundred sixty-six million people who speak it as their first language (Grimes 2001). A dental consonant is a consonant articulated with the tongue against the upper teeth, such as /t/, /d/, /n/, and /l/ in some languages. Hindi language have an entire set of dental stops that occur phonemically as voiced and voiceless and with or without aspiration. The nasal /n/ also exists but is quite alveolar and apical in articulation.<sup>18</sup>To native speakers, the English alveolar /t/ and /d/ sound more like the corresponding retroflex consonants of their languages than like dentals., As certain consonants used in Hindi like /f/, /s/ are also commonly used ones in English that require presence of maxillary anterior teeth for their pronunciation, survey was conducted in Hindi as well with mentioning of same consonants.<sup>18</sup>

Snow<sup>19</sup> studied the articulation of 438 male and female children with a mean age of 7 years, 2 months. Her sample size was divided into a group whose incisor teeth were present and another whose maxillary incisor teeth were missing or grossly abnormal. Both groups were tested for the articulation of 6 consonant sounds. She found that a significantly larger number of children with missing or abnormal maxillary incisors misarticulated sounds vs. those with an intact dentition. The results also showed that some children with intact dentitions did not make sounds correctly.<sup>19</sup>One of the aims of this current study was to examine the impact if any, that missing maxillary incisors had on the development of speech articulation in young children. Despite the limited sample size, our study results showed that 12.8% of children with missing incisors showed problems with speech, a trend that may be verifiable with a larger subject population. These results seem to suggest that the early loss of incisor teeth may compromise the development of normal speech articulation in young children. Thus, every effort must be made to prevent their loss, particularly from dental trauma and ECC, through parental education.

Riekman and el Bradrawy<sup>17</sup>, they recruited 14 subjects who had undergone extraction of their 4 maxillary incisors. In their study, the average age at extraction was 34 months old, and they carried out speech evaluations at approximately 109 months of age. They found that 40% of subjects displayed some degree of speech distortion. In study by Abimbola O. Adewumi<sup>20</sup>, they found for children with missing incisors who were perceived by their parents to sound different, 46% were found to have problems pronouncing “s” and “z” based on the speech evaluation. But there are studies as well that in which parents do not find any speech changes like one by Koroluk and Riekman<sup>21</sup> were they investigated parental perceptions of children who had extensive nursing caries that necessitated extraction of the 4 maxillary incisors.<sup>19</sup>They found that, of the 52 parents who responded to mailed questionnaires, 62% claimed their child had no difficulty speaking or learning to speak, and 77% said they did not

notice any change in their child's behaviour after the incisors were extracted. Also, due to the abundance of speech tests and speech testing criteria in use nowadays, it is difficult to compare or establish a norm from the findings of different studies reporting on the prevalence of impaired speech in a normal child population. Two British studies<sup>22, 23</sup> conducted on a national sample of more than 15, 000 7- year-old children reported that 10-13% of children had an appreciable degree of speech impairment and between 1 and 2% had a marked speech defect though hearing normally. A Canadian study<sup>24</sup> on 1454 children, 6- to 15-year-old children showed that 8% had defects of speech not associated with hearing loss. It should be noted that in these studies, no dental history was obtained and no data are available with regard to premature loss of primary teeth. In our study, we found out that 12.5% of parents reported noticing a difference in their child's speech amongst which 3.9% said they observed changes in speech following extraction of Primary maxillary teeth.

Despite the long-standing views of professionals, parents may not always perceive speech problems in their children following premature loss of maxillary primary incisors, like speaking about the awareness we found through this study, 28.6 % parents were aware of role of upper anterior teeth in development of normal speech & effect of loss of teeth on speech impairment, suggesting of low awareness. Whereas only 8.6% parents were aware about preventive treatment options that avoid development of abnormal speech after loss of upper anterior teeth.

We propose that future studies involve speech evaluations in the early and late mixed dentition stages, researchers may be able to identify the potential benefit of early intervention in alleviating both short and long term speech deficits following PEMPI.

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