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Effect of premature loss of primary maxillary incisors on speech

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Abstract

The speech of 14 children who had had their maxillary primary incisors extracted as a result of nursing bottle caries, was evaluated using a standard test of articulation. The average age at which the extractions were performed was 34 months and the average age at which the articulation test was given was 109 months.

The results showed that 4 of the children had some degree of speech impairment. Two of those were mild impairments (not in need of therapy) and the 2 others were rated as severe (in need of corrective therapy). Three of those children were males and 1 was female.

The findings of this study suggest that some degree of speech impairment may develop and persist in later years if premature extractions of the 4 maxillary primary incisors are performed in children younger than 3 years of age.

It long has been considered that speech development and the ability to articulate certain speech sounds are dependent on many related factors among which is the presence of the anterior maxillary teeth. Due to the ravages of dental caries, especially nursing bottle caries, the maxillary incisors often must be extracted in very young children. The purpose of this study was to evaluate the long-term effects on speech and articulation in children who have had their maxillary anterior teeth extracted at an early age.

Literature Review

The teeth serve as useful landmarks for the tongue and play a prominent role during the production of certain speech sounds.[1] Defective speech may be caused by a variety of factors other than loss of teeth including malocclusion, tongue tie, cleft palate, shortness of the soft palate, dentures or bridges planned without regard for phonetic consequences, and fear of showing unsightly dentition.[2]

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.[1] Consequently, loss of teeth would permit too much air to escape, distorting sound production. The anterior teeth appear to be particularly important for correct production of the *s* and *z* sounds. Indeed, the anterior teeth are reported by Fant[3] to be the actual source of sibilance in the *s* sound. Jensen[4] verified Fant's findings, but also added that the correct *s* sound can be produced without approximation of the incisors toward an edge-to-edge relationship in patients with normal occlusion and that the incisors never approximate to an edge-to-edge position in patients with Class II, Division I malocclusion who articulate the *s* sound correctly.

As there are individuals with normal dentitions and faulty speech and others with defective dentitions and normal speech, Kessler further speculated that perhaps other incipient factors such as the individual's intelligence, play a role in determining whether the person can compensate for his mechanical oral disability.

Snow[5] 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. The results showed that a statistically significant larger proportion of children with missing or abnormal upper incisors misarticulated sounds compared with the group with an intact dentition. The

results also showed that some children with intact dentitions did not make the sounds correctly.

In a study of 304 children by Bankson and Byrne a comparison was made on the articulation of selected sounds before and after exfoliation of primary anterior teeth.[6] The children's speech was tested before loss of the primary incisors and then retested 4 months after loss of the teeth. The mean age of the sample was 73 months at the time of the posttest. Results indicated that the only sound showing a statistically significant change at the time of the posttest was the *s* sound. The study concluded by stating that missing teeth will not influence the speech patterns of many children.

Methods and Materials

For the purpose of this investigation, the dental records of all children treated by the first author (GR) in a 7-year period (January, 1975 — December, 1981) were reviewed for selection of suitable subjects. Criteria for selection were:

1. Children with a history of nursing bottle caries that had necessitated extraction of the 4 maxillary primary incisors
2. Children whose extractions were performed at least 2 years (chosen arbitrarily) prior to the start of the investigation with no prosthetic replacement placed in the interim
3. Children whose medical history showed no medical or developmental condition that would adversely influence normal physical and mental development.

The selection process identified 135 children fitting the established criteria. Of the parents contacted, only 14 consented to take part in the study. Many families had moved and could not be located, while others resided in distant rural districts and did not wish to make the trip into the city for the necessary evaluation. These factors account for the small sample size utilized in the present study.

The 14 subjects (8 males, 6 females) who took part in the study presented at the speech therapy service of the University Hospital where each child was evaluated independently by 2 speech therapists. The Goldman-Fristoe[7] test of articulation was utilized. The test consists of a set of well-defined pictures, the names of which contain each of the consonant sounds in the initial, medial, and final positions of words.

The subjects then were seen at the Dental College, where their medical and dental histories were verified and updated. All subjects had had only routine restorative and prophylaxis treatments since the extraction of their 4 maxillary incisors.

The average age of the subjects was 34 months at the time of the extractions, and 109 months at the time of the speech evaluation test (average time between the extractions and the test = 75 months). Table 1 identifies the children in the sample.

Table 1. Patient Identification

Name	*Sex*	*Age Teeth Extracted*	*Age Speech Tested*
1. CF	M	15 mo	71 mo
2. SC	M	22	106
3. TH	F	22	119
4. CW	M	23	104
5. CP	F	23	120
6. DC	M	31	112
7. SR	M	34	65
8. KK	M	35	138
9. DB	F	35	107
10. RF	F	35	133
11. BL	M	40	132
12. KP	M	52	112
13. CS	F	52	101
14. LW	F	54 mo	102 mo

Results

The results revealed that 2 children (CF and SC) had some mild speech distortions and 2 others (CP and DC) had severe distortions of speech and needed corrective therapy (Table 2).

For the total sample of children with a history of premature primary maxillary incisor extractions, 40% displayed some degeree of speech distortion. These children had an average age of 22.75 months (1.9 years)

Table 2. Patients Displaying a Degree of Speech Impairment

Age Teeth Extracted	*N*	*Patients with Defective Speech*			*Defective Speech as %*		
		Mild*	Severe+	Total	Mild*	Severe+	Total
0 - 24 mo	5	2	1	3	40	20	60
25 - 48 mo	6	0	1	1	0	16.6	16.6
49 - 60 mo	3	0	0	0	0	0	0

* Mild: no need for corrective therapy.
\+ Severe: corrective therapy indicated.

at the time of the extractions and 102.25 months (8.5 years) at the time of the speech evaluation.

The remaining 10 children all had acoustically normal speech. Their average ages at the time of the extractions was 53.10 months (4.4 years) and 111.30 months (9.3 years) at the time of speech evaluation.

The speech therapist's report concluded by stating, "It would seem that most children who have primary incisors extracted at an early age make compensations to produce correct auditory sounds (i.e., positioning of tongue and lips, and adjustment of the air stream)."

Discussion

There have been few studies of the effect of premature primary anterior tooth loss on speech development and the authors are unaware of any that have investigated the long-term effect of anterior tooth loss on speech and articulation.

Of the six components necessary for development of normal speech (respiration, phonation, resonation, articulation, neurologic integration, and audition),[1,8] articulation is the component most affected by the presence or absence of teeth.[9] 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. The studies cited have shown that loss of anterior teeth does affect articulation, especially of the *s* sound, but that many children manage to compensate and articulate the sounds correctly even when anterior teeth are missing.

A factor that may not be too well understood in relation to phonetics is that of tooth proprioception. The process of perception involves the sensory innervation of the periodontal membrane, epithelial surfaces of the oral cavity, muscles of mastication, muscles of the tongue, and the TMJ joints.[10] Proprioceptive input from the anterior teeth possibly could play an important role in the acquisition and retention of the correct sound skills, with their loss resulting in defective functioning of part of the system. Crum and Loiselle[10] state that, "the extraction of all natural teeth results in complete loss of tooth proprioception which has helped to program the masticatory system throughout a large portion of the patient's life. It also results in the loss of the discrete discrimination that the natural teeth possess regarding directional sensitivity, dimensional proprioception, and tactile sensitivity to load." Ghi and McGivney[11] further studied the role of tooth proprioception and its effect on the production of the *s* sound *in edentulous denture patients* and concluded that the precision of speech movement is affected by the presence of tooth proprioception.

Obviously, age is an important factor to consider in speech evaluation. If a dental defect such as extraction of maxillary incisors occurs before the child has mastered the sounds, the dental defect may present an obstacle to acquisition of the correct language skill. If the same defect occurs after the acquisition of these skills, only a transient disruption of the sounds may be expected until the time when compensatory mechanisms come into action.[12] With regard to the *s* sound, data indicate that it is first acquired by children as early as 3 years of age and used consistently by the age of 8 years at the beginning, middle, and end of words by 90% of children.[13] All children in the sample except two (CF), mild speech distortion and SR, normal speech) were older than 8 years at the time of the speech evaluation test.

While the present sample size is too small to draw specific conclusions, it is still interesting that the 4 children displaying some degree of speech impairment were all younger than 3 years, at the time the maxillary incisors were extracted, and 3 of those were younger than 2 years. As shown in Table 2, this yields a 60% prevalence in children whose extractions were performed before age 2, 16.6% for those 2-4 years, and 0% for those 4-5 years.

Due to the abundance of speech tests and speech testing criteria in use, 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[14,15] 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[16] on 1454 6- to 15-year-old children showed that 8% had defects of speech not associated with hearing loss. The findings also reflected a greater tendency for males to display a speech impairment compared to females. This tendency was also evident in the present sample. 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.

Given the difficulties in attempting a comparison with other studies as well as an awareness of the small size of this sample, it is still noteworthy that these results indicate a considerably larger prevalence of some degree of speech impairment (40%). Such a greater prevalence possibly could be linked to the extractions performed in those children younger than 3 years.

A positive cause-and-effect relationship between the premature loss of the 4 primary maxillary incisors and the possibility that speech difficulties might arise and persist could be established only by further controlled studies on larger population groups.

Conclusion

The premature loss of the 4 primary maxillary incisor teeth does not appear to have any long-term effect on the speech development of most children whose speech was tested at ages 5.4-11.5 years.

Inconclusive evidence suggests that minor residual effects may accrue if such extractions are performed in children younger than 3 years of age and that this tendency may increase the younger the child is at the time of the extractions. As seen in other studies, it appears that males are more prone to develop speech difficulties than females.

The role of tooth proprioception in the acquisition and retention of articulatory skills deserves further study.

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Quotable quote: hyperactivity by any other name

Childhood hyperactivity has been in the medical literature since the 1880s. Today it remains a controversial subject. Perhaps the confusion stems from the fact that symptoms of hyperactivity may be associated with several disorders, such as mental retardation or drug and poison-related illnesses.

The misunderstanding also may be aggravated by the fact that the condition has many names: hyperkinetic reaction, hyperkinetic syndrome, learning disability, minimal brain dysfunction, minor cerebral dysfunction, minimum cerebral dysfunction, and hyperactive child syndrome.

Attention deficit disorder, which comes from the standard diagnostic reference of the American Psychiatric Association (APA), is the latest of these.

Hadley J: Hyperactivity. Child Today, July-August, 1984