

Damage to the primary dentition resulting from thumb and finger (digit) sucking

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Thumb and finger-sucking are common habits among young children, being practiced by some 50 percent at one year of age.¹⁻³ The number decreases rapidly, however, by ages four to five years.¹⁻³ Traisman and Traisman reported the average age for spontaneous cessation of the thumb-sucking habit to be 3.8 years.² Many reports have related thumb and finger-sucking to malocclusions, particularly when continued for a long period of time.^{2,4-6} Traisman and Traisman documented a highly significant difference in the number of malocclusions, 9.7 percent in thumb-suckers compared to 6.5 percent in non-thumb-suckers.² Johnson documented malocclusions in 989 patients and determined that 17.49 percent had sucked the thumb or finger.⁴ Anterior open bite is the most frequent malocclusion reported with digit sucking.

Few studies have documented the influence of thumb and finger-sucking on both anterior and posterior components of the primary dentition. We investigated the influence of thumb and finger-sucking both in the anterior and posterior sections of the primary dentition in three age-groups (three, four and five years).

MATERIAL AND METHODS

This study consisted of a retrospective review of the charts of 2018 normal Japanese pediatric patients from three to five years of age, who had attended the Aichi-Gakuin University Pediatric Dental clinic. The respective nature of the oral habits was determined from the clinical records, which depended upon parent and patient answers as to the type of oral habit.

In order to investigate the relationship between thumb and/or finger-sucking and malocclusion, 930 subjects meeting the following inclusion criteria were selected from the original 2018 children:

- Those who only indulged in digit sucking.
- Those with no oral habits.
- Subjects with complete primary dentition and no permanent teeth erupting.
- Subjects with no dental caries, restorations and/or missing teeth.

The subjects were divided into two groups—those with no history of oral habits (671 children) and those who indulged in thumb or finger-sucking (259 children) (Table 1). Patients were categorized according to age, sex and presence or absence of the habit.

Data regarding anterior overjet, overbite and whether the second primary molars exhibited a mesial step, distal step or flush terminal plane were obtained from the clinical records and previously obtained study models

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Table 1 □ Control and experimental subjects. (number of patients)

	Non-oral habits			Thumb and/or finger sucking			Total
	Male	Female	Total	Male	Female	Total	
3 yrs	175	141	316	56	79	135	451
4 yrs	106	99	205	40	51	91	296
5 yrs	74	76	150	13	20	33	183
Total	355	316	671	109	150	259	930

Table 2 □ Criteria for classification of primary occlusion.

Overjet	Normal Maxillary protrusion Mandibular protrusion Normal range is defined as follows: Horizontal overlap distance between incisors is within 5 mm (including 0 mm)
Overbite	Normal Open bite Deep overbite Normal range is defined as the vertical overlap distance approximately one-half of mandibular incisor, including edge to edge.
Terminal plane	Mesial step Flush terminal plane Distal step

mounted on hinged axis articulators. Mandibular protrusion was diagnosed, albeit somewhat arbitrarily, by what was considered to be an exaggerated mesial-step terminal plane relationship of the second primary molars. Occlusion details are depicted in Table 2.

Our hypothesis was that there would be a higher incidence of overjet and overbite in the thumb/finger-sucking group compared to age-matched controls who had no oral habit.

STATISTICAL ANALYSIS

Data for the non-oral-habit group were compared with those for the thumb and/or finger-sucking group. Results were analyzed using the Chi-square test with $p < 0.05$ being the level of significance.

RESULTS

Of the original 2018 children, 1206 (59.8 percent) demonstrated no oral habits, while 812 (40.2 percent) indulged some form of oral habit. Of the 812 children who were determined to indulge an oral habit, 734 exhibited only one oral habit. Seventy-eight of the children, however, actually indulged two oral habits. Thus there were 812 children exhibiting a total of 890 oral habits; 400 (19.8 percent) indulged in thumb or finger-sucking. Other oral habits included nail biting (9.1

Table 3 □ Types of oral habit of 2018 children.

	Number of children			Type of oral habit (Number of cases)				
	Total	Non-oral habits	Oral habits	Thumb & finger sucking	Nail biting	Bruxism	Lip sucking or biting	Others
3 years	918	561	357	195	74	59	14	47
4 years	622	360	262	129	59	57	21	23
5 years	478	285	193	76	50	51	12	23
Total	2018	1206	812	400	183	167	47	93
		(59.8%)	(40.2%)	(19.8%)	(9.1%)	(8.3%)	(2.3%)	(4.6%)

All figures represent the number of cases per 2018 subjects. Of 812 children who indulged some form of oral habit, 734 exhibited only one habit. However, 78 children actually indulged two oral habits. Thus there were 812 children exhibiting a total of 890 oral habits.

Table 4 □ Frequency of types of overjet. Number of patients (%)

		3 yrs	4 yrs	5 yrs
		Non-oral habits	Maxillary protrusion	30 (9.5)
	Normal	253 (80.1)	172 (83.9)	126 (84.0)
	Mandibular protrusion	33 (10.4)	13 (6.3)	9 (6.0)
Thumb and finger-sucking	Maxillary protrusion	32 (23.7)	15 (16.3)	8 (24.2)
	Normal	99 (73.3)	74 (80.4)	23 (69.7)
	Mandibular protrusion	4 (3.0)	3 (3.3)	2 (6.1)

percent), bruxism (8.3 percent), lip sucking or biting (2.3 percent) (Table 3).

As previously documented, in order to investigate the relationship between digit sucking and malocclusion, 930 subjects meeting the investigative criteria were selected from the original 2018 children.

The frequencies of normal type overjet were 80.1 percent to 84.0 percent for the non-oral-habit group (depending on age) and 69.7 percent to 80.4 percent for the thumb and finger-sucking group. These were the highest frequencies for all ages in both groups. The fre-

MAXILLARY PROTRUSION

quencies of maxillary protrusion of the non-oral-habit group were 9.5 percent in three-year-old children, 9.8 percent in four-year-old children and 10.0 percent in five-year-old children. For the thumb-sucking group the frequencies were 23.7 percent in three-year-old children, 16.3 percent in four-year-old children and 24.2 percent in five-year-old children. Comparing both groups, the frequencies of the thumb and finger-sucking group were higher at all ages than those of the non-oral-habit group, a particularly significant difference being noted in the three-year-old children ($p < 0.05$, chi-square test). In contrast with these results, the frequencies of mandibular protrusion for the thumb and finger-sucking group of

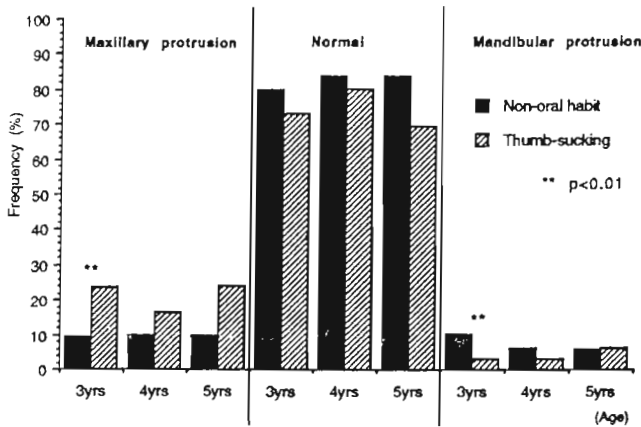


Figure 1. Comparison of types of overjet of thumb-sucking and non-oral habit groups.

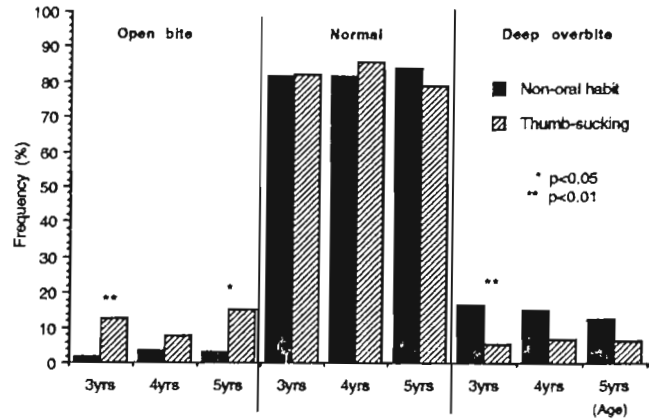


Figure 2. Comparison of types of overbite of thumb-sucking and non-oral habit groups.

three and four-year-old children were lower than those of the non-oral-habit group (Table 4, Figure 1).

Normal overbite frequencies were 81.5 percent to 84.0 percent for the non-oral-habit group, and 78.8 percent to 85.7 percent for the digit-sucking group. These frequencies were the highest for all ages in either group. The frequencies of open bite in the non-oral-habit group were approximately 2.0 percent to 3.0 percent in all age-ranges. For the digit-sucking group, the frequencies were 12.6 percent in three-year-old children, 7.7 percent in four-year-olds and 15.1 percent in five-year-olds. Comparing both groups, the digit-sucking group showed higher frequencies at all ages than the non-oral-habit group, a particularly significant difference being noted in the three and five-year-olds ($p < 0.05$, chi-square test). Contrasting with these results, the frequencies of deep overbite at all ages of the digit-sucking group were lower than those of the non-oral-habit group (Table 5, Figure 2).

Variations of terminal plane types in three and four-year-old children were not significant, when comparing the non-oral-habit group with the digit-sucking group. In the distal step type of four-year-old children, how-

ever, the frequency of the digit-sucking group (8.8 percent) was higher than that of the non-oral-habit group (2.9 percent). In five-year-old children, the mesial step terminal plane type of the digit-sucking group (27.3 percent) was less frequent than that of the non-oral-habit group (51.3 percent) and the distal step terminal plane of the digit-sucking group (12.1 percent) was noted more frequently than that of the non-oral-habit group (1.4 percent). Overall, these frequencies exhibited significant differences (Table 6, Figure 3).

DISCUSSION

Without a doubt, thumb-sucking and finger-sucking are the most common of the numerous oral habits prac-

OVERBITE AND OVERJET

ticed by children. This study examined the incidence of occlusal deformation, as demonstrated by overbite and overjet, in children who sucked their thumb or fin-

Table 5 □ Frequency of types of overbite. Number of patients (%)

		3 yrs	4 yrs	5 yrs
Non-oral habit	Open bite	6 (1.9)	7 (3.4)	5 (3.3)
	Normal	258 (81.5)	167 (81.5)	126 (84.0)
	Deep overbite	52 (16.5)	31 (15.1)	19 (12.7)
Thumb and finger-sucking	Open bite	17 (12.6)	7 (7.7)	5 (15.1)
	Normal	111 (82.2)	78 (85.7)	26 (78.8)
	Deep overbite	7 (5.2)	6 (6.6)	2 (6.1)

Table 6 □ Frequency of types of terminal plane. Number of patients (%)

		3 yrs	4 yrs	5 yrs
Non-oral habit	Mesial step	136 (43.0)	73 (35.6)	77 (51.3)
	Flush terminal plane	165 (52.2)	126 (61.5)	71 (47.3)
	Distal step	15 (4.8)	6 (2.9)	2 (1.4)
Thumb and finger-sucking	Mesial step	54 (40.0)	36 (39.6)	9 (27.3)
	Flush terminal plane	75 (55.6)	47 (51.6)	20 (60.6)
	Distal step	6 (4.4)	8 (8.8)	4 (12.1)

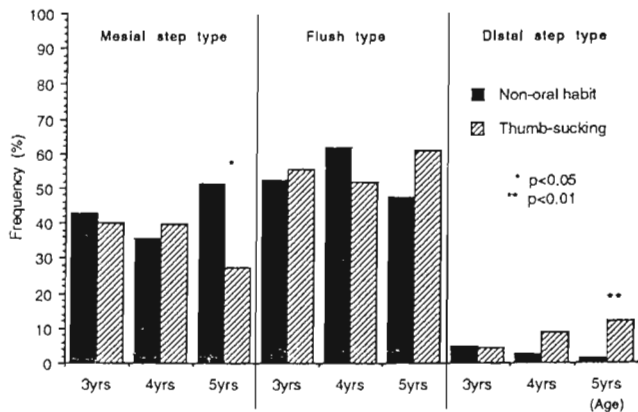


Figure 3. Comparison of types of terminal plane of thumb-sucking and non-oral habit groups.

ger, compared with those who did not indulge the habit. A secondary purpose of the study was to determine the most appropriate age for attempted elimination of the habit.

Numerous studies have reported on the perceived effects of digit sucking. Klackenberg studied 259 children between ages four and six years of age and reported that 50 percent had been thumb-suckers.¹ The number of those persisting with the habit gradually decreased with age, until only 21 percent were sucking their thumbs by age five years. Kurosu *et al.* reported an overall incidence of 13.8 percent in children between ages one and eleven years.³ Our study reported the highest frequency of all documented oral habits with 40.2 percent of children exhibiting some type of oral habit, 19.8 percent indulging in thumb or finger sucking.

The frequency of thumb-sucking differs with each report. These differences may be due to many factors, including method and date of the investigation, age-range of subjects, race and social or nursing environment. The constant agreement of all these reports is that digit-sucking is the most common habit of young children.

Anterior open-bite and maxillary protrusion represent the most frequent malocclusion associated with digit-sucking. Traisman *et al* reported that 9.7 percent of thumb-suckers developed this malocclusion compared to 6.5 percent of non-thumb-suckers. Johnson *et al* reviewed 989 patients with malocclusion, ages ranging from two years and six months to nineteen years: 17.49 percent had a history of thumb or finger-sucking.⁴

Graber, took the opposing view that some of the damaging consequences of the habit are related to hereditary type Class II, Division 1, malocclusion.^{5,6} Clearly, accu-

rate investigation of damage to the occlusion resulting from thumb and finger-sucking requires careful comparisons between control and sucking groups. In order to exclude extraneous factors, the data in our study compared the digit-sucking group with the non-oral-habit group. We found a 23.7 percent incidence of maxillary protrusion in three-year-old children who sucked their thumbs. The figures were 16.3 percent for four-year olds and 24.2 percent for five-year olds. Open-bite frequencies for the digit-sucking group were 12.6 percent in three-year olds, 7.7 percent in four-year olds, and 15.1 percent in five-year olds. The frequency rates of open-bite and maxillary protrusion for the digit-sucking group were higher than the non-oral habit group at all ages.

POSITIVE CAUSE

Clearly, thumb and finger-sucking in young children cause malocclusion of the anterior segments. In the present study, frequencies of open-bite and maxillary protrusion did not result in such a large difference at each age-group. It may be postulated, therefore, that damage to the anterior segment may result from thumb and finger-sucking at an early stage, before three years of age.

Studying the relationship between posterior malocclusion and digit-sucking, Johnson reviewed 153 patients between two and nineteen years of age and reported that 47.7 percent exhibited an Angle Class II malocclusion.⁴ Unfortunately, this study did not include a control group, i.e. the non-oral-habit group.

In five-year-old children, the mesial step terminal plane occurred less frequently and the distal step terminal plane more frequently in the thumb-sucking group than in the non-oral-habit group. The frequencies in these groups showed significant differences. This increased tendency of the distal step type started with children age four-years. This led us to the conclusion that posterior damage, unlike anterior damage, is a late reaction and that changes in the terminal plane may be the result of a malocclusion intensified by protracted indulgence in the habit.

The most significant damage to the occlusion of the first permanent molars may occur shortly after this stage.

CLASS II RELATIONSHIP

since the distal surfaces of the second primary molars guide the erupting first permanent molars into position. Arya *et al* and Nabeta *et al* noted, however, no case

exhibiting a distal step in the primary dentition in which the anteroposterior relationship was altered by eruption of the first permanent molar.^{7,8} In every case the final occlusion of the permanent dentition was an Angle Class II relationship.

In this study, the influence of the terminal plane would appear to be in accordance with the opinions of Arya and Nabeta, supporting the view that thumb and finger-sucking should be eliminated before appearance of damage to the terminal plane.^{7,8} Since the terminal plane begins to change at four years of age, the age of cessation should be three to four years. Graber held the view that the elimination age of thumb and finger-sucking should be three years of age.^{5,6}

Clearly, natural correction of the malocclusion caused by thumb and finger-sucking is related not only to the degree of malocclusion, but also to lip and tongue function as well as that of other perioral musculature. It is our belief that the elimination age of thumb and finger-sucking is a most important factor. The evidence of this study points to three to four years of age as the most appropriate range, the period in which thumb and finger-sucking have been reported to stop spontaneously.^{2,3}

CONCLUSION

This study investigated the effects of thumb and finger-sucking on the anterior and posterior regions of the primary dentition of children three to five years of age: 400 (99.8 percent) of 2018 children were found to suck a finger or thumb.

At all ages, the frequencies of open-bite and maxillary protrusion for the thumb and finger-sucking group were

higher than the non-oral-habit group. The frequencies did not appear to be age-related. It was noted that the anterior region may be affected by thumb and finger-sucking at an early stage (before three years of age).

In five-year-old children, the mesial step terminal plane type of the thumb-sucking group demonstrated significantly lower malocclusion frequencies and the distal step terminal plane type significantly higher frequencies than those of the non-oral-habit group. There was an increased tendency to a permanent malocclusion in the distal step type in children who continued after four years of age.

The results of this study suggest that thumb and finger-sucking should be eliminated before damage is done to the terminal plane. This would appear to be between three and four years of age.

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ADOLESCENT SMOKERS

Adolescents become addicted to cigarettes, with approximately one half attempting to quit and failing by the age of 17 years. This suggests that they may benefit from medical intervention to achieve abstinence, but there are no published studies of the risks and benefits of nicotine therapy in young patients. It would therefore be more important than in older patients to verify addictive smoking (e.g., by measurements of salivary cotinine or carbon monoxide in expired air) before treatment, to minimize the possibility that the medication would cause higher levels of tolerance and physical dependence than cigarette smoking.

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