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Original Article

A LIP SEAL STUDY OF JAPANESE CHILDREN WITH MALOCCLUSION

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Abstract

The purpose of this study was to clarify the relationship between lip seal and malocclusion in Japanese children. Fifty-three patients aged 7 to 14 years (mean 10.24±1.93) were selected randomly, and compared with 20 subjects with normal occlusion aged 7 to 14 years (mean 10.50±2.56). The subjects were divided into a good lip seal group and poor lip seal group by observing the distance between the upper and lower lip at rest. The variables that were analyzed for morphological evaluation included model analysis and cephalometric analysis. Noted for functional evaluation were tongue position, the size of the tonsils and adenoids and the oral muscle force measured by button pulling. In the evaluation of the degree of lip seal, there was no statistical difference between subjects with malocclusion and those with normal occlusion. Within the group with malocclusions, however, there were significant differences in overbite ($p<0.01$), overjet ($p<0.01$), and oral muscle force by button pulling ($p<0.05$) between the good lip seal and poor lip seal groups. These results suggest that there is a need not only to correct malocclusion but also to be aware of lip sealing so that it may be improved in Japanese children.

Key words: Lip seal—Overbite—Overjet—Oral muscle force

INTRODUCTION

It is known that a poor lip seal may influence the position and inclination of teeth because of a lack of balance between tongue and lip pressure[2,10]. Mew[8] and Trotman *et al.*[14] stated that poor lip sealing may affect not only tooth position but also mandibular position and direction of growth and that poor lip seal was also associated with a loss of esthetics through vertical mandibular growth. Although there are some reports on the effect of lip sealing in this regard, influences of lip seal on morphology and function in young Japanese[1,13] are not clear. The purpose of this study was to clarify the relationship between the degree of lip seal and malocclusion in Japanese children.

SUBJECTS AND METHOD

Fifty-three patients with malocclusion (20 boys, 33 girls, average age 10.24±1.93 years old) were selected randomly, and compared with 20 children with normal occlusion (10

Table 1 Numbers of subjects

	Normal occlusion (average age 10.50±2.56 years)	Malocclusion (average age 10.24±1.93 years)				
		Crowding	Maxillary protrusion	Anterior cross-bite	Total	Total
Boys	10	5	7	8	20	30
Girls	10	12	13	8	33	43
Total	20	17	20	16	53	73

Fifty-three patients with malocclusion were selected randomly, and compared with 20 children with normal occlusion. The classifications of the malocclusion, such as crowding, maxillary protrusion and anterior cross-bite.

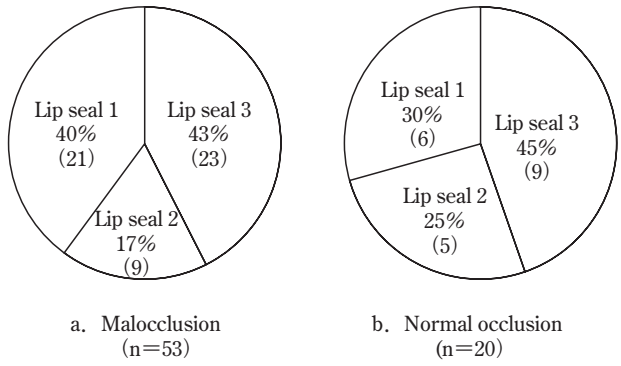

Fig. 1 Distributions of lip seal degree
The subjects were divided into a good lip seal group (Lip seal 1: sealed up to less than 4 mm apart) and a poor lip seal group (Lip seal 3: over than 8 mm apart) by observing the degree of space between the upper and lower lip at rest while counting from 1 to 6 by the method of Mew[8].

boys, 10 girls, average age 10.50±2.56 years). The classifications of the malocclusion, such as crowding, maxillary protrusion and anterior cross-bite, are shown in Table 1.

The subjects were divided into a good lip seal group (Lip seal 1: sealed up to less than 4 mm apart) and a poor lip seal group (Lip seal 3: over than 8 mm apart) by observing the degree of space between the upper and lower lip at rest while counting from 1 to 6 by the method of Mew[8]. Lip seal 2 (from 4 mm to 8 mm apart) was omitted. The lip seal 2 was omitted to clarify the difference between the good lip seal group and poor lip seal group[3].

The morphology analyzed overbite, overjet, upper crowding, lower crowding, upper molar width, and lower molar width. The cephalometric tracing followed the method of Ricketts analysis. The indicator lines[8], which were the distance from the tip of the nose to the incisal edge of the upper left central incisor (upper indicator line) and the lower left central incisor to the lowest ranking point of soft tissue (lower indicator line), were measured. For entity instrumentation of the face, the distance from the os parietale to soft tissue of the gnathion and the width between the right and left zygomatic arch were measured.

For functional evaluation, the presence of

Table 2 Reproducibility of lip seal

Count	Subject A	Subject B
1	3	5
2	2	6
3	3	5
4	2	7
5	3	6
Average	2.6	5.8
S.D.	0.55	0.84

(mm)

Reproducibility was confirmed by several repeated measurements and statistical calculations.

Table 3 Results of morphological analysis

	Poor lip seal group ($n=23$)		Good lip seal group ($n=21$)		
	mean	S.D.	mean	S.D.	
Denture (mm)					
Overbite	4.25	2.34	2.23	1.59	**
Overjet	4.91	4.65	1.5	2.63	**
Upper crowding	−2.5	2.82	−2.73	2.74	
Lower crowding	−3.18	2.75	−2.66	3.29	
Upper molar width	45.32	2.34	46.58	2.72	
Lower molar width	40.19	1.81	42.18	2.66	
Face (mm)					
Facial height	216.1	0.98	214.81	0.98	
Facial width	127.61	1.24	138.13	1.39	
Ratio	58		59		
Upper indicator line	39.61	3.11	37.95	3.43	
Lower indicator line	47.39	4.89	44.86	4.44	

**: $p<0.01$

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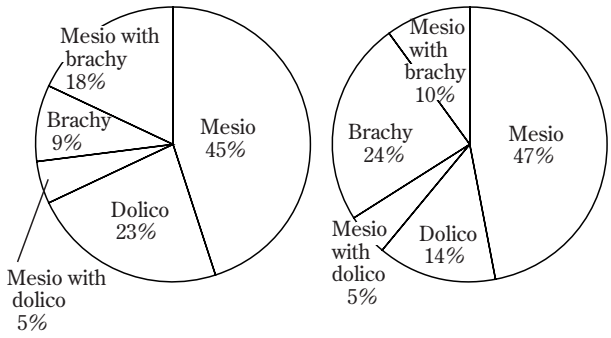
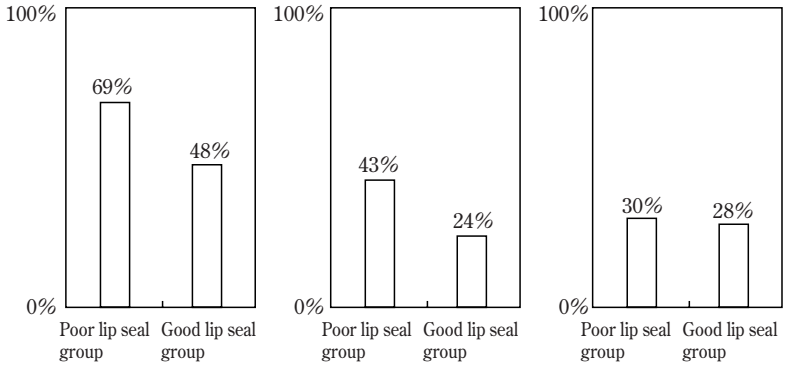
or a medical history of conventional otorhinology were investigated. Tonsil and adenoids were inspected and classified according to Mackenzie[11] and analyzed by McNamara airway[7] with X-ray cephalograms. Tongue behavior was inspected and evaluated according to the degree of tongue protrusion during swallowing and pronunciation. Oral muscle force was measured by button pulling (15 mm diameter) with a tension gauge (HaldexAB:



a. Poor lip seal group b. Good lip seal group

Fig. 2 Distribution of facial type
The cephalometric tracing followed the method of Ricketts analysis.



a. Percentage of patients with mouth breathing
b. Percentage of patients with tonsils and adenoids
c. Percentage of patients with allergy

Fig. 3 Functional evaluation
The presence of or a medical history of conventional otorhinology were investigated. Tonsil and adenoids were inspected and classified according to Mackenzie[11] and analyzed by McNamara airway[7] with X-ray cephalograms.

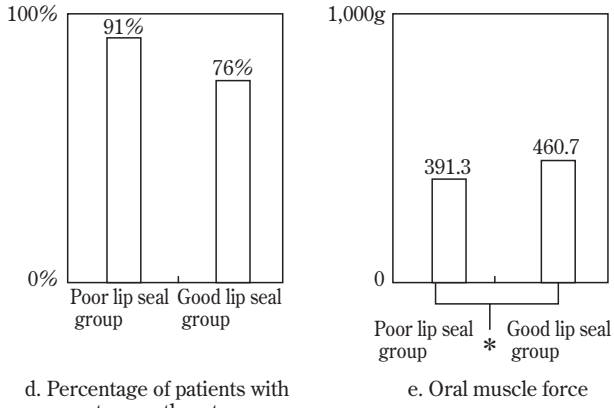
HALDA Sweden).

Differences between the groups were determined by the χ^2 test for mouth breathing, observation of tongue position, history of allergy, tonsils, presence of adenoids and by the *t*-test for evaluating the significance of morphological evaluations.

RESULT

No statistical differences were found between malocclusion and normal occlusion upon evaluation of the degree of lip seal (Fig. 1). Reproducibility was confirmed by several repeated measurements and statistical calculations (Table 2).

Within the group of malocclusions, however, there were significant differences between the good lip seal group and poor lip seal group in relation to overbite ($p<0.01$) and overjet ($p<0.01$) (Table 3). No significant difference was recognized by facial type (Fig. 2). The oral muscle force by button pulling ($p<0.05$) differed between the two groups (Fig. 4-e). Mouth breathing, tongue position, tonsil hypertrophy, adenoids and allergy were not statistically different (Fig. 3-a, b, c, 4-d).



d. Percentage of patients with tongue thrust

e. Oral muscle force

Fig. 4 Functional evaluation
Tongue behavior was inspected and evaluated according to the degree of tongue protrusion during swallowing and pronunciation. Oral muscle force was measured by button pulling (15 mm diameter) with a tension gauge (HaldexAB: HALDA Sweden).

DISCUSSION

Thüer[13] measured the distance between the upper and lower lip on X-ray cephalograms. Alan[1] compared the open lip posture with the closed lip posture and remarked that there is little error in such observations of lip posture. We measured the distance between the upper and lower lip at rest between phonation.

Thüer[12] reported that lip pressure tended to decrease in children with a large overjet, long dental arches and proclined incisors. Yoshino[9,15] reported that lip function influenced the inclination of the upper and lower incisors. Within our subjects with malocclusions, there were significant differences in overbite and overjet between the groups with good lip seal and poor lip seal. Improvement of overjet and overbite is important in achieving in good lip seal.

On the other hand, Trotman *et al.*[14] stated that a more open lip posture was associated with a more backwardly rotated face and a greater lower facial height. Alan[1] reported that children with an open mouth posture displayed a significantly slower pattern of maxillary growth than children who display an anterior lip seal posture. Mew[8] used the indicator line with some success in forecasting patterns of growth in young children. However, no significant difference based the indicator line was found in our study. There was no difference by face type either. The difference between Mew's results and ours may be due to racial characteristics or to evaluation of longitudinal observations.

Trotman *et al.*[14] pointed out that mouth breathing can be a cause of an open mouth and that an open lip posture, reduced sagittal airway, and large tonsils were each associated statistically with this characteristic. However, tonsil hypertrophy, adenoids, and allergy were not statistically relevant in our study. Nasal breathing is possible along with mouth breathing, and there is a need to differentiate habitual mouth breathing from mouth breathing due to airway problems.

Oral muscle force as tested by button pulling was small, an average of 426 g in our study. The differences in this result from those in other reports[5] may depend on the measuring tool, the size of the button or the rate at which it was pulled. Oral muscle force was significantly lower in the poor lip seal group in our study. Fränkel[4,12] claimed that lip seal training was effective in activating and improving the tone of the muscles and proper mandibular

position. This indicates importance of lip seal training for perioral configuration during the growth period.

Glatz[6] described that normal children under the age of 3 years and 9 months kept their lips together for an average of only about one-sixth of the observation time and determined at what age children generally start to close their lips. With this survey, lip seal deficiency was not a little in the normal occlusion group. Fränkel[4] stated that the lack of anterior oral seal is a symptom of behavioral immaturity which points to the psychosocial aspects of poor postural control of the orofacial musculature. Environmental factors, such as Japanese phonation, dietary habits and differences in aesthetic appreciation are as related to lip seal as the physiological poor lip seal at a young age. The need to not only correct malocclusion but also to be aware of lip seal so that it may be improved in Japanese children should be considered.

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