a report of saliva secretion as a factor contributing to tongue-coating[8], no data correlated with the motor function of oral organs such as the tongue and cheeks have yet been reported. Therefore this study examined the relation between the degree of tongue-coating and lingual motor function relating to mastication, swallowing and articulation.

Materials and methods

Study population

Forty-eight subjects (mean age, 80.8 ± 7.8 years: 13 men with mean age of 76.7 ± 8.5 and 35 women with mean age of 82.6 ± 6.8) were selected from the participants in 'Lectures on Oral Health' held at day-care centres at four locations in Tokyo, Japan. The selection criteria of subjects were that the patients were to be able to live semi-independently but with some help required for walking or going up or down stairs, and not to have periodontal pockets deeper than 4 mm. No subjects had ever used brushes for the tongue. Four subjects were regular smokers at the time of the survey.

On ethical considerations, written consent was obtained from the subjects, to whom the objectives, methods and projected results of the study had been explained orally and in written form. This study was approved by the Ethics Committee of the The Nippon Dental University, School of Life Dentistry at Tokyo.

Transverse survey

A transverse survey on the condition of tongue-coating and associated factors was performed in October 2005, and the results were compiled and summarised in 2007. The survey time was set between 10:00 AM and 12:00 noon, more than 2 h after having breakfast.

Evaluation items

Tongue-coating status. Tongue-coating status was visually evaluated according to the following four grades; Score 0: not visible, Score 1: less than one-third of the tongue dorsum covered, Score 2: less than two-thirds covered, and Score 3: more than two-thirds covered[9].

Lingual motor function. Lingual motor function was evaluated from the power speed and range of motion. The power of the tongue was judged from the maximum tongue pressure generated by the tongue pressing against the palate, measured according to the method of Hayashi *et al.*[10]. Subjects were instructed to press a balloon-like sensor with their tongue onto the front part of the palate as strongly as possible. When subjects had been able to practise several times, the mean value of five measurements was obtained.

The speed and extent of tongue motions were evaluated by oral diadochokinesis[11]. In this test, subjects were instructed to repeat the sound 'ta' or 'ka' for 10 s as fast as possible. The number of syllables pronounced repeatedly per second was recorded.

Masticatory performance. Masticatory performance was measured using the masticatory performance evaluation gum product of LOTTE Co., Ltd (Tokyo, Japan)[12,13]. The colour of this gum changes gradually to red as its saliva-soluble pigment leaks out with chewing. Subjects were asked to 'chew the gum very hard' for 5 min. After chewing, the gum was collected, covered with polyethylene film, and pressed into a thickness of 1.5 mm between two glass plates. After removing the glass plates, masticatory performance was evaluated through the polyethylene film with a chromaticity meter (CR-13, KONICA MINOLTA, Tokyo, Japan).

Hayakawa *et al.*[13] evaluated the colour of the chewed gum using the 'L*', 'a*' and 'b*' colour space, which was developed by the Commission Internationale de l'Eclairage[14] for measuring object colour. In the colour space, 'L*' indicated lightness and 'a*' and 'b*' were chromaticity co-ordinates. The co-ordinate 'a*', representing the degree of red, was measured and found that as the number of chews increased, the value of 'a*' increased. The chewed gum was measured at three random points, and the mean 'a*' value of three measurements was used for analyses. The number of chewing cycles was also recorded.

Condition of oral cavity. The oral condition was evaluated from oral hygiene and dryness. The former was evaluated from the presence of dental plaque on the teeth and dentures. Dental plaque was evaluated using a three-level scale; DPI1: dental plaque on half or more of the teeth surface, DPI2: dental plaque on less than half of the teeth surface, and DPI0: no plaque[15].

Oral dryness was evaluated on the following scale of four grades according to the method of Kakinoki *et al.*[16]; Grade 0: not dry (and does not show Grade 1, 2, or 3 condition), Grade 1: saliva shows viscosity, Grade 2: saliva shows tiny bubbles on the tongue, and Grade 3: dry tongue, without viscosity, little or no saliva present.

Life style. Daily oral hygiene practice was surveyed by recording the frequency of oral cleaning. In addition, smoking status was recorded at the time of the survey.

Interventional study

An interventional study was performed to examine the effect of oral motor function training on tongue-coating in 27 subjects (mean age, 82.4 ± 7.2 years) with more than the median degree of tongue-coating judged by the transverse survey. Consent had also been obtained from these subjects. This aspect of the study was performed between October and December 2005 and the results were also compiled and summarized in 2007.

Oral functional training

Oral motor function training was performed for 20 min once a week for 2 months at the day care centre. The training regimen was: (i) repeatedly touching the left and right sides of the oral cavity alternately (for 10 s, two times), (ii) repeatedly sticking the lips forward and pulling the corners of the lips sideways (for 10 s, three times) and (iii) pressing the tongue on the palate (for 10 s, three times). The regimen of training exercises was supervised by dentists and dental hygienists. Subjects were trained directly by dental hygienists and instructed to practice the regimen by themselves once a day also at home.

After 2 months, the subjects with tongue-coating were examined to evaluate the effect of training of lingual motor function.

Statistical analysis

The correlations between tongue-coating and each factor were analysed by chi-squared test, Fisher direct probability test, Mann–Whitney *U*-test, and Kruskal–Wallis test. The data of the interventional study were analysed by Wilcoxon test.

Results

Status of tongue-coating

Table 1 shows the status of tongue-coating and each factor. Tongue-coating was absent in nine subjects, and present at a low, moderate, and high degree in 11, 21, and seven subjects respectively.

Lingual motor function

The tongue pressure and the frequency of repeating the syllable 'ka' showed a statistically significant correlation with the degree of tongue-coating (tongue pressure: $p = 0.008$, */ka/*: $p = 0.037$). $p < 0.05$ was considered statistically significant. However, masticatory performance and the frequency of repeating the syllable 'ta' or 'ka' showed no significant differences with the degree of tongue-coating (masticatory performance: $p = 0.859$, */ta/*: $p = 0.061$).

Condition of oral cavity

Oral hygiene and dryness showed no significant difference with the degree of tongue-coating (oral hygiene; $p = 0.191$, oral dryness; $p = 0.741$).

Table 1 Status of tongue-coating and each factor.

Tongue-coating status	*Total*	*Score 0*	*Score 1*	*Score 2*	*Score 3*	*p-value*
Number of subjects	48	9	11	21	7	–
Age (year)	80.8 ± 7.7	80.8 ± 7.7	77.8 ± 8.7	81.0 ± 7.1	84.3 ± 7.5	0.571
Number of natural teeth	9.8 ± 9.9	10.2 ± 11.0	14.6 ± 10.1	6.6 ± 25.0	11.1 ± 10.3	0.159
Number of functional teeth	25.6 ± 9.7	26.9 ± 1.8	23.9 ± 6.5	25.0 ± 7.1	27.9 ± 0.4	0.409
Masticatory performance[a]	18.9 ± 7.4	18.9 ± 5.6	15.3 ± 12.6	20.2 ± 4.9	19.9 ± 5.6	0.859
Tongue pressure (kPa)	31.7 ± 13.4	33.6 ± 13.7	35.0 ± 9.5	35.0 ± 12.2	16.5 ± 11.7	0.008*
Repeating the syllable */ta/* (times/second)	4.5 ± 1.7	5.8 ± 1.2	4.4 ± 1.5	4.2 ± 1.8	4.0 ± 1.8	0.061
Repeating the syllable */ka/* (times/second)	4.2 ± 1.6	5.5 ± 1.0	4.4 ± 1.8	3.8 ± 1.5	3.6 ± 1.8	0.037*
Frequency of oral cleaning (times/day)	1.7 ± 1.0	2.2 ± 1.1	2.1 ± 1.0	1.3 ± 0.9	1.6 ± 0.8	0.188

*$p < 0.05$ was considered statistically significant.
[a]Degree of red in the colour space, developed by Commission Internationale de l'Eclairage.

Life style

The frequency of oral cleaning showed no significant differences with the degree of tongue-coating (frequency of oral cleaning: $p = 0.138$).

Changes after oral functional training

The 27 subjects who participated in the interventional study consisted of nine men with a mean age of 80.2 ± 6.9 and 18 women with a mean age of 83.4 ± 7.3. By training of oral function, masticatory performance, the frequency of repeating the syllable 'ta' and 'ka', the oral hygiene level and the frequency of oral cleaning significantly improved (masticatory performance: $p = 0.0001$, /ta/: $p = 0.0268$, /ka/: $p = 0.037$, oral hygiene level: $p = 0.0004$, frequency of oral cleaning: $p = 0.015$). In addition, a statistically significant difference was observed in the degree of tongue-coating ($p = 0.0001$).

Discussion

Factors that have been reported to contribute to the accumulation of tongue-coating include periodontal disease[9], frequency of oral cleaning[17] and smoking[18]. In addition, it is known that tongue-coating is seen more frequently in elderly people than in young people, probably because of life-style change, reduced brushing efficiency, reduced secretion of saliva, and changes in saliva content[3,8]. In patients with periodontal disease, tongue-coating is formed from adherence of leucocytes, which increase in the saliva[19]. It has also been reported that anatomical changes of the tongue, such as a decrease of fungiform papillae and an increase of filiform papillae, cause an increase in tongue-coating[2,20].

Concerning the correlation of tongue-coating and oral function, there is a reported correlation with saliva secretion[8]. However, there are little data on the correlation with motor function of oral structures such as the tongue and cheeks. As tongue-coating increases in the aged, who have reduced or impaired oral function, it could be assumed that there might be a correlation between tongue-coating and oral function.

Regarding the selection of subjects, those with periodontal pockets deeper than 4 mm were excluded from the study, in order to reduce the effect of periodontal disease as much as possible. The degree of tongue-coating changes diurnally, as with halitosis[9], and therefore, the time of the survey was set at 2 h after the morning meal.

As tongue brushes have shown efficacy for removing the coating[17], and mouth rinsing is effective in decreasing tongue-coating and halitosis, we examined the daily habit of oral cleaning in each subject to clarify the relationship.

Normally, the oral cavity has various self-cleaning functions such as saliva flow and/or motions of the tongue and lips during mastication or talking, which control the number of micro-organisms adhering to the teeth[21]. These oral motor functions and saliva secretion are known to decrease in the aged[6,7]. The motor function of the tongue can be evaluated from the range, power, speed, and complexity of motion, in addition to muscular endurance. As all the subjects had a wide range of the tongue motion, only tongue pressure and oral diadochokinesis were evaluated as indicators of power and speed of the tongue. Tongue pressure is an important indicator of tongue function, and correlates well with swallowing function[22] and nutritional status[23], which are known to decline with age[10]. Oral diadochokinesis is a method to evaluate clarity, rhythm, and repetition frequency following repeating an indicator sound as rapidly as possible, and is used for evaluation of articulation impairment observed in neuromuscular diseases[11]. Different parts of the oral muscles can be evaluated by selecting indicator sounds with different articulatory points; 'ta' with the articulatory point at the tip of the tongue and 'ka' with the articulatory point at the dorsum of the tongue were used in this study.

A significant (negative) correlation of tongue-coating with tongue pressure and the 'ka' sound was observed. It is reported that tongue-coating tends to accumulate on the dorsum of the tongue[24]. Interestingly, tongue-coating was negatively correlated with the function of the dorsum of the tongue. Although the adhesion site of tongue-coating was not examined in this study, it would be important to examine indicator sounds of oral diadochokinesis and the adhesion site of tongue-coating in the future.

Furthermore, we examined the effect of lingual motor function training on tongue-coating in the subjects. After the training, significant changes were observed in masticatory performance and the repeating frequency of the sounds 'ta' and 'ka', along with a significant decrease in tongue-coating. An effect of training of oral function has been observed in the aged[25]. The decrease in tongue-coating appeared to be the result of improvement of function, even though the subjects were more than 80 years old. Meanwhile, as the frequency of oral cleaning increased significantly, oral cleaning may

also have contributed to the decrease of tongue-coating. It is known that motivation is essential for efficient training of oral function[28]. In this study, the importance of improving oral self-cleaning function as well as improving their masticatory function to ensure the effect of oral motor function training was explained to the subjects. Based on this motivation, the subjects started to pay attention to oral health including tongue-coating, and showed an increased interest and this awareness may have contributed to the increase in frequency of oral cleaning following functional training. However, it was uncertain which was the main cause of the decrease in tongue-coating, the improvement of oral motor function including tongue movement, or the increase in the frequency of oral cleaning. In other words, the degree of tongue motor function seems to have been influenced not only by the frequency of oral cleaning but also by the improvement of lingual motor function. Consequently, it was suggested that the lingual motor function, as well as the frequency of oral cleaning, have greatly contributed to the results of this study.

Conclusion

The present study showed an important finding that lingual motor function correlates with a decrease in tongue-coating, and can be improved by oral function training. These results should contribute to maintaining oral health in people of advanced age.

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ORIGINAL ARTICLE

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Oral motor function and masticatory performance in the community-dwelling elderly

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Abstract This study was performed to ascertain the relationships between oral motor functions, such as those of the tongue and lips, and age in the community-dwelling elderly, as well as to investigate the effects of these factors on masticatory performance. The subjects were 268 healthy elderly Japanese living in Kyoto. They were divided into four age groups and further classified into the following two groups by the presence or absence of posterior occlusal support: Eichner A or B1–B3 (group A), and Eichner B4 or C (group B). They were wearing removable or fixed dentures if they had missing teeth. Oral function evaluation items included (1) masticatory performance and (2) oral motor skills. Significant differences were noted among the age groups in tongue pressure within group A ($P < 0.01$) and group B ($P < 0.05$), and in the number of repetitions of the syllables /ta/ and /ka/ in group B (/ta/: $P < 0.05$, /ka/; $P < 0.01$). The number of natural teeth ($\beta = 0.463$, $P < 0.001$) in group A and tongue pressure ($\beta = 0.436$, $P < 0.001$) in group B were the only predictors of masticatory performance when the data were analyzed by multiple regression analysis. The tongue may compensate for the missing teeth in masticatory performance of those elderly who have lost their natural teeth. The results of this study highlight the importance of tongue function in masticatory performance.

Key words Mastication · Occlusal support · Oral motor function · Community-dwelling elderly · Aging

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Introduction

It is well known that a decrease of masticatory performance affects nutrient intake.[1,2] Furthermore, masticatory performance, which is closely related to quality of life,[3] is essential to the maintenance of the activities of daily living in the elderly. In some reports, the number of teeth, the state of occlusal support, and denture stability have been shown to be factors associated with masticatory performance.[4–6] Mastication is controlled by suprabulbar structures, and consists of coordinated movements of masticatory organs such as the tongue, lips, cheeks, and mandible. Motor functions of these organs are known to deteriorate with age[7] and to influence masticatory performance. However, there are only a few reports on the relationships between changes in tongue and lip function and masticatory performance with age.[8] This study was performed to ascertain the relationships between motor functions of the tongue and lips and age in the community-dwelling elderly, as well as to investigate the effects of these factors on masticatory performance.

Subjects and methods

The subjects were 268 healthy elderly Japanese (86 men, 182 women) 65 to 88 years of age living in Kyoto who participated in a health seminar sponsored by Kyoto Prefectural University of Medicine.

The age groups consisted of 77 subjects 65–69 years old (22 men and 55 women), 86 subjects 70–74 years old (30 men and 56 women), 66 who were 75–79 years old (21 men and 45 women), and 39 who were 80 years or older (13 men and 26 women). All were able to walk without assistance from a caregiver or family member and had no physical or mental dysfunction, nor any speech impairment that interfered with daily activities. Moreover, the subjects had no clinical symptoms such as caries, periodontal disease, periodontitis, or temporomandibular disorders that could influence masticatory performance, and they were wearing

Table 1. Groups of subjects based on occlusal status

	Total no. of subjects (male/female)	Mean age (range) (years)	Average number of natural teeth
Group A	190 (60/130)	72.8 (67.4–76.6)	25.1 ± 4.8
Group B	78 (26/52)	76.3 (70.5–82.1)	7.6 ± 6.7

Group A, naturally adequate dentition; Group B: denture wearers

removable or fixed dentures if they had missing teeth. Subjects with pain from dentures or who were wearing poorly fitting dentures at the time of the survey were excluded from the study.

The subjects were further classified into two groups by the presence or absence of posterior occlusal support by natural teeth (Table 1): group A, subjects who still had occlusal support in the premolar and molar regions, corresponding to Eichner A or B1–B3; and group B, subjects who had no occlusal support in the premolar or molar regions, corresponding to Eichner B4 or C.

The number of natural teeth was counted, and the averages are shown in Table 1. Oral function evaluation items included (1) masticatory performance and (2) oral motor skills.

Determination of masticatory performance

Masticatory performance was measured by using a color-changeable chewing gum (Lotte, Tokyo Japan) designed for judging masticatory ability.[9] The subjects were instructed to chew the gum very hard for 3 min. The gum was collected immediately after the 3 min of chewing and pressed to a thickness of 1.5 mm by covering it with a polyethylene film and then placing it between two glass plates. Then, the glass plates were removed and color measurements of the gum with the polyethylene film were performed with a colorimeter (CR-13, Konika Minolta, Tokyo, Japan). The measurements were performed at three random points on the gum, and the average a* value was analyzed. The chewing rate was also measured.

Oral motor skills

Tongue movement was evaluated as the maximum pressure generated by the tongue pressed to the palate, by using the method of Hayashi et al.[10] The subjects were instructed to push a balloon-like sensor as hard as possible against the anterior palate using their tongues. After this maneuver had been repeated several times, until their manner of chewing had stabilized, the measurement was performed five times and the average value was calculated. The subjects were instructed to pronounce a monosyllable repeatedly for 10 s as fast as possible to test oral diadochokinesis.[11] The evaluator recorded the number of repeated syllables and calculated the number of syllables produced per second. The monosyllables used for the evaluation were /pa/, /ta/, and /ka/.

Prior to this study, we explained the objectives, method, and expected outcomes to the subjects orally and in writing and obtained their consent. This study was approved by the Ethics Committee of the Nippon Dental University, School of Life Dentistry at Tokyo.

Statistical analysis

Relationships among the age groups and the results of each oral function evaluation were analyzed by analysis of variance and Tukey's method. An unpaired *t* test was used to analyze the statistically significant differences in subjects between groups A and B. Furthermore, Pearson's correlation coefficient was calculated to study the relationships between the oral function evaluation items and a*. Multiple regression analysis using the stepwise method was performed, setting the items for which significant relationships were observed as independent variables. $P < 0.05$ was considered statistically significant.

Results

Relationships among oral motor function, occlusal support, and age

Relationship between masticatory performance and age. The average a* value, an indicator of masticatory performance, was greater in group A than in group B (16.0 and 12.6, respectively, $P < 0.001$). No significant differences were noted among the age groups in either group A or group B (Table 2).

Relationship between chewing rate and age. The average chewing rate in 3 min was higher (203.7) in group A than in group B (170.3) ($P < 0.001$). No significant differences were noted among the age groups within either group A or group B (Table 2).

Relationship between tongue pressure and age. The average tongue pressure value was similar in groups A and B (34.9 and 34.2 kPa, respectively). Significant differences among the age groups were noted within both group A ($P < 0.01$) and group B ($P < 0.05$) (Table 2).

Relationship between oral diadochokinesis and age. The average number of repetitions of the syllables /pa/, /ta/ and /ka/ per second was higher in group A than in group B ($P < 0.001$). No significant differences among the age

Table 2. Relationship among oral function, occlusal support, and age

Age (years)	Number of subjects		a*		Chewing rate (times/3 min)		Tongue pressure (kPa)		/pa/ (repetitions/s)		/ta/ (repetitions/s)		/ka/ (repetitions/s)	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Total	190	78	16.0 (3.0)	12.6 (4.4)	203.7 (44.2)	170.3 (33.7)	34.9 (8.9)	34.2 (11.0)	6.5 (0.7)	6.2 (0.8)	6.5 (0.7)	6.2 (0.9)	6.3 (0.8)	5.9 (0.9)
<70	65	12	16.3 (2.7)	12.5 (3.0)	206.2 (44.1)	174.8 (20.2)	37.2 (9.5)	38.0 (10.4)	6.4 (0.7)	6.2 (0.6)	6.5 (0.7)	6.4 (0.6)	6.3 (0.9)	6.3 (0.5)
70–74	67	19	16.1 (3.0)	12.3 (5.0)	206.3 (42.8)	166.6 (33.5)	34.5 (8.0)	36.7 (8.9)	6.5 (0.8)	6.4 (0.6)	6.5 (0.8)	6.4 (0.6)	6.4 (0.7)	6.3 (0.5)
75–79	45	21	15.4 (3.3)	14.0 (3.9)	196.9 (38.4)	179.2 (38.1)	34.4 (8.8)	37.5 (10.3)	6.4 (0.6)	6.4 (0.7)	6.5 (0.8)	6.4 (0.8)	6.1 (0.7)	5.9 (0.8)
≥80	13	26	16.5 (3.6)	11.9 (4.7)	201.2 (68.5)	163.7 (35.1)	27.0 (7.4)	28.0 (11.2)	6.5 (0.6)	5.9 (1.0)	6.5 (0.6)	5.6 (1.2)	6.3 (0.5)	5.4 (1.2)
P value*			0.428	0.445	0.675	0.596	0.002	0.016	0.981	0.347	0.947	0.016	0.466	0.004

Values are mean (SD)
* Analysis of variance. Tukey's test results: tongue pressure, group A: <70 vs. ≥80 ($P < 0.001$), 70–74 vs. ≥80 ($P < 0.05$), 75–79 vs. ≥80 ($P < 0.05$); group B: <70 vs. ≥80 ($P < 0.05$), 70–74 vs. ≥80 ($P < 0.05$), 75–79 vs. ≥80 ($P < 0.05$); /ta/, group B: 70–74 vs. ≥80 ($P < 0.05$), 75–79 vs. ≥80 ($P < 0.05$); /ka/, group B: <70 vs. ≥80 ($P < 0.05$), 70–74 vs. ≥80 ($P < 0.01$) ( )

groups were noted in either group for syllable /pa/, but for syllables /ta/ and /ka/, significant differences were noted among the age groups in group B (Table 2).

Predictors of masticatory performance by multiple regression

In group A, masticatory performance was significantly correlated with chewing rate ($P < 0.01$) and with the number of natural teeth ($P < 0.0001$). In group B, masticatory performance was significantly correlated with the number of repetitions of the syllable /ta/ ($P < 0.05$), the chewing rate ($P < 0.05$), and tongue pressure ($P < 0.0001$). The number of natural teeth ($\beta = 0.463$, $P < 0.001$) was the only predictor in group A of masticatory performance, and tongue pressure ($\beta = 0.436$, $P < 0.001$) was the only predictor in group B, according to the multiple regression analysis of masticatory performance using the stepwise method.

Discussion

Subjects and methods

In this study, in all subjects any missing teeth had been restored. We did not evaluate the quality of dentures of each subject at the time of study. However, we considered none of the subjects to be wearing dentures of markedly inferior quality because all of them were satisfied with their dentures. Therefore, we inferred that there was no effect of quality of dentures on our study results.

There are two methods for measuring masticatory ability: a direct testing method that uses a test food, and an indirect testing method that uses other factors related to mastication such as jaw movement, muscle activity, occlusal contact status, and occlusal force. The test food used in the direct testing method is usually chewing gum,[12] gumdrops, peanuts,[13] or ATP granules. The size of the crushed food, sugar flowing from the crushed food, and the amounts of gelatin, glucose, starch, and pigment are measured and evaluated using the colorimetric method and weight. Other studies have also reported on a testing method using food, including a sieve analysis[14] and an artificial test food analysis for mastication.[15,16] In this study, we used a newly developed color-changeable chewing gum, employing it as a test food in the direct testing method to evaluate masticatory ability. The original yellow-green color of the gum turns to red with chewing because citric acid in the gum is eluted and mixed with saliva in response to chewing, which increases the pH of the gum.[5] The red color level is expressed as the a* value. There are two masticatory performance measurement methods: one based on chewing a sample a certain number of times and another based on chewing a sample for a certain number of minutes. Our subjects were elderly and we feared that they might have movement disorders, so we avoided placing an excessive burden on them during the study. Therefore, we adopted the latter method, evaluating

masticatory performance based on their chewing a sample for a certain number of minutes, in order to obtain values reflecting the subject's usual masticatory performance. The time was set at 3 min, and the subjects were instructed to "chew the gum as usual" so that their form of mastication was not restricted. According to a report on healthy dentulous subjects by Hirano et al.,[8] who developed this method of measuring masticatory performance, elution of citric acid is complete when the food has been chewed 160 times or the color change to red is complete. The results of our study indicated that the average chewing rate in 3 min was approximately 200, which fulfilled their criterion of the food having been chewed 160 times. Accordingly, we consider our study to have sufficiently evaluated masticatory performance.

The motor functions of the tongue and lips were evaluated by tongue pressure and oral diadochokinesis. We previously reported the relationship between tongue pressure and swallowing function in the elderly using a simple tongue pressure measuring system.[17] From those results, we assumed tongue pressure to possibly be an important indicator of oral motor skill. Oral diadochokinesis is used to diagnose dysarthria associated with neuromuscular diseases.[18] With this method, subjects are asked to repeatedly pronounce an indicator sound as fast as they can for a given number of minutes in order to evaluate the clarity and rhythm of the sound. Furthermore, different sites can be evaluated by choosing indicator sounds that have different points of articulation. In this study, we selected /pa/, which has a point of articulation on the lips, /ta/, which has a point of articulation at the tip of the tongue, and /ka/ which has a point of articulation on the dorsum of the tongue, as indicator sounds.

Results

The results revealed that masticatory performance did not deteriorate with age, but that the presence or absence of occlusal support influenced masticatory performance. The ability to repeat the syllable /pa/ was not influenced by age. We previously reported, in our study on labial function as indicated by the vertical labial-closing pressure, that the pressure was higher in healthy elderly subjects compared to the healthy adult and less likely to decline in the healthy elderly.[16] The vertical labial-closing pressure indicates the amount of lip movement, while the number of repeated syllables indicates the speed of movement and the oral movement skill, which cannot be directly compared. However, the results of this study, that there were no differences due to age in the number of repetitions of the syllable /pa/, may support our previous report showing no decrease in labial function in the elderly.

An influence of age on tongue pressure was noted in both groups, which indicated that tongue pressure decreased with age regardless of the presence or absence of occlusal support, which is consistent with the findings of Hayashi et al.[19]

An influence of age on the number of repetitions of the syllables /ta/ and /ka/ was noted in group B alone, in which the subjects had occlusal support restored by dentures in place of natural teeth. Many studies have reported that muscle strength or physical function is weakened by aging.[19,20] Our further investigation revealed that tongue motor function is well maintained up to the age of 80, but a significant difference was noted between the age group younger than 80 years old and that 80 years or older, suggesting this function is more likely to be affected by age in elderly people 80 years old or older.

Regarding the average number of repetitions of the syllables /ta/ and /ka/, only in subjects in group B were the results influenced by age. This suggests that removable dentures, which restore number of missing teeth, might influence pronunciation, since the tongue needs to be in contact with the teeth as well as with the palate in order to pronounce /ta/ and /ka/.

Multiple regression analysis results showed a strong correlation with masticatory performance of the number of teeth in subjects of group A, and tongue pressure in subjects of group B, perhaps reflecting the relative decrease in the role of teeth in masticatory performance. Furthermore, the tongue may compensate for missing teeth in the masticatory performance of the elderly who have lost natural teeth and whose remaining teeth do not function adequately. Masticatory performance has been studied in various groups, including dentate subjects and denture wearers,[21] as well as in subjects with implant-retained overdentures,[22] and masticatory performance is reportedly reduced significantly when dentures replace natural teeth. A few studies have focused on the relationships between masticatory performance and salivation[23] or oral sensation.[24] Furthermore, mastication is controlled by the suprabulbar structures and consists of coordinated movements of masticatory organs such as the tongue, lips, cheeks, and mandible. These motor functions are known to deteriorate with age[7,25,26] and in relation to neuromuscular diseases associated with movement disorders.[27,28]

The results of this study highlight the importance of tongue function in masticatory performance. Therefore, masticatory disorders might occur more frequently as a result of oral motor dysfunction in the elderly.

Our results indicate that motor functional training for improvement of tongue function[29] as well as an appropriate prosthesis may be useful for restoring masticatory performance in the elderly in whom these functions have deteriorated.

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—— 原　　著 ——

肺炎発症に関する口腔リスク項目の検討
—口腔ケア・マネジメントの確立に向けて—

Selection of Essential Assessment Items for Oral Care Management

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抄録：口腔ケア・マネジメントを確立していくうえで，肺炎リスクを疑うべき口腔の問題を明確にしておくことは必須の課題である。そこで今回，全国19カ所の介護施設入所者172名（男性46名，女性126名，平均年齢84.0歳）を対象に肺炎リスク群を選定し，それらの口腔にかかわる問題点を検討した。その結果，スクリーニングにより選別された肺炎リスク群は56名（男性18名，女性38名，平均年齢84.0歳）であり，これらの者では，要介護度が有意に高く，開口保持，咀嚼運動が困難やできない者が有意に多いことが示された（$p<0.05$）。以上のことは，口腔機能の低下した者で肺炎リスクが高まることを示唆しており，歯科医療者との連携による口腔機能の評価が効果的で効率的な口腔ケア提供体制の確立には重要であることを示している。

キーワード：要介護高齢者，口腔ケア，スクリーニング，アセスメント

緒　　言

高齢者の病態および疾患の特徴としては，個人差が大きい，症状が非定型的であるといったものがあり，歯科疾患についても同様のことがいえる[1]。とりわけ，要介護高齢者では自ら症状を訴えたり歯科医院を受診したりすることが困難となることも多いため，介護者の協力がないもとでは歯科疾患が潜在化する恐れがある[2]。

さらに，2005年7月に厚生労働省医政局より医療機関以外の高齢者介護の現場などにおいて，原則として医行為ではないと考えられるものが通知された。ここでは，重度の歯周病などがない場合の日常的な口腔内の刷掃・清拭において，歯ブラシや綿棒または巻き綿子などを用いて，歯，口腔粘膜，舌に付着している汚れを取り除き清潔にすることも挙げられている。このことは，高齢者介護や障害者介護の現場に定着してきた口腔ケアを考えるうえでは，きわめて妥当な通知といえるものの，一方で，歯科医学的管理が必要な要介護高齢者をより潜在化させる恐れもある。

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重度の歯周病などがあるかどうかを歯科専門職以外の者が評価することは困難であり，歯科疾患を潜在化させてしまわないためには，歯科専門職と施設職員が緊密に連携していく必要がある[3]。この歯科との連携のキーワードとしては，最近注目が集まってきている摂食嚥下機能や誤嚥性肺炎予防といったものがあるが[4]，どのような口腔の問題が肺炎のリスクを高めるかといったことについて，歯科専門職として把握しなければならない具体的な評価項目については，これまでほとんど検討されていない。

そこで本研究では，簡易なスクリーニングにより選択された肺炎リスクの高い要介護高齢者の口腔関連領域の問題についてアセスメントシートを用いて評価することで，肺炎のリスクとなりえる口腔機能について検討を行った。

対象者および方法

対象者は，全国19カ所の介護施設入所者のうち，従前に歯科医師もしくは歯科衛生士による専門的口腔ケアを受けたことのない172名（男性46名，女性126名，平均年齢84.0歳）とした。なお，口腔ケアの提供は本人もしくは家族などからの希望があり，今回の調査に同意した者のみとした。

本研究は日本歯科大学生命歯学部倫理委員会の承認を得た。

これらの対象者に対して，各施設に常勤もしくは非常勤として勤務している歯科衛生士によって，図1に示すスクリーニングシートを用いて評価を行った。このうち今回は，歯科衛生士が看護師などへの聞き取り調査を行ったスクリーニングシートの口腔機能の項目の中から，誤嚥性肺炎の既往に「繰り返す発熱あり」「あり」，食事中や食後のむせに「あり」，食事中や食後の痰のからみに「いつもからむ」，口腔乾燥が「著明」，頭部精診にて「むせ・呼吸切迫あり」のいずれかを回答した者を肺炎リスク群として選択した。

次いで，過去の報告[5,6]を参考に表1のような口腔関連領域のアセスメント項目を作成し，スクリーニングシートと同様，歯科衛生士による評価を行った。得られたアセスメント項目への回答を要介護度については，要介護度1から要介護度3までの者と要介護度4，5の2群に，それ以外の項目は選択肢

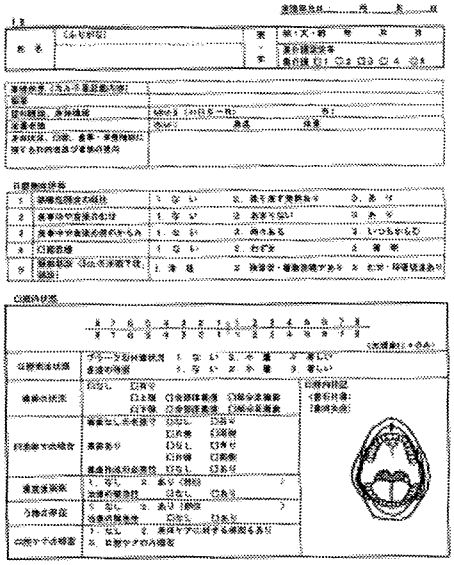

図1．用いたスクリーニングシート

の中から1と回答した者とそれ以外の者の2群にそれぞれ分割した。

統計学的分析はSPSS 15J for Windowsを用いて，肺炎リスク群と対照群の性別，年齢および残存歯数をχ^2検定ならびにMann-WhitneyのU検定を用いて比較した。次いで，両群間で有意差のあるアセスメント項目の選択をχ^2検定により行った。さらに，危険率0.1%未満において肺炎リスク群と有意な関係を示した項目を用いてロジスティック回帰分析を行い，肺炎発症のリスクとなりうる要因の選択を行った。

結　　果

表2にスクリーニングシートの中の口腔機能評価に対する回答結果を示す。これらの回答結果には重複もあることから，選択された肺炎リスク群は56名（男性18名，女性38名，平均年齢84.0歳）となった。一方，選択されなかった対照群は116名（男性28名，女性88名，平均年齢84.1歳）であり，両群間の性別，平均年齢に有意な差はなかった。また，残存歯数もリスク群で10.7±9.4本，対照群で

表1　アセスメントに用いた項目とその対象者数

		対象者数（名）
要介護認定	要介護度　1	23
	要介護度　2	25
	要介護度　3	38
	要介護度　4	44
	要介護度　5	42
気管チューブ	1．留置なし	170
	2．留置あり	2
経管栄養	1．なし	151
	2．あり（胃瘻，経鼻，その他）	31
口腔ケアの自発性	1．なし	76
	2．時々ある	33
	3．いつもある	50
座位保持	1．可能	120
	2．困難	35
	3．不可能	13
頸部可動性	1．十分	121
	2．不十分（前屈，左・右回旋）	33
	3．不可　（前屈，左・右回旋）	16
開口保持	1．可能	137
	2．困難	23
	3．不可能	8
口腔内での水分保持	1．可能	104
	2．困難	19
	3．不可能（むせ，飲んでしまう）	31
含嗽	1．可能	97
	2．困難	21
	3．不可能（むせ，飲んでしまう）	37
咀嚼運動	1．咀嚼運動できる（下顎の回転のあるもぐもぐ様の運動可能）	116
	2．下顎および舌の上下運動可能	18
	3．下顎の上下運動のみ	10
	4．ほとんど下顎の動きなく嚥下	13

11.9±8.6本と差はなかった。

各アセスメント項目への回答結果を表1に示す。各項目で評価できていなかった者を除いて肺炎リスク群と対照群ごとのアセスメント項目の関係を表3に示す。気管チューブ以外のすべての評価した項目で危険率0.1%未満の強い有意な関係が認められた。そこで，気管チューブを除く各項目と肺炎リスク群との関係をロジスティック回帰分析により検討した結果，要介護度，開口保持，咀嚼運動が肺炎リスク群の判定に有意となる診査項目であることが示

表2　スクリーニング項目への回答結果

口腔機能評価		対象者数（名）
誤嚥性肺炎の既往	1．ない	139
	2．繰り返す発熱あり	12
	3．あり	21
食事中や食後のむせ	1．ない	131
	2．あまりない	18
	3．あり	23
食事中や食後の痰のからみ	1．ない	140
	2．時々ある	28
	3．いつもからむ	4
口腔乾燥	1．ない	132
	2．わずか	40
	3．著明	0
頸部聴診（3ccの水嚥下後，聴診）	1．清聴	122
	2．残留音・複数回嚥下あり	39
	3．むせ・呼吸切迫あり	11

誤嚥性肺炎の既往に「繰り返す発熱あり」「あり」と回答した者，食事中や食後のむせに「あり」，食事中や食後の痰のからみに「いつもからむ」，口腔乾燥が「著明」，頸部聴診にて「むせ・呼吸切迫あり」と回答した者を肺炎リスク群とした。

された（$p<0.05$）（表4）。

考　　察

本研究の結果，肺炎リスクの高い要介護高齢者の特徴として，要介護度が高いことに合わせて，開口保持や咀嚼運動ができないといった口腔機能の低下があげられることが示された。

大類らは[7]，誤嚥性肺炎の発生メカニズムとして，脳血管障害や進行性の神経・筋疾患がある者で嚥下反射や咳反射が低下して不顕性誤嚥が生じることの背景に，ADLの低下にともなう身体抵抗性の低下があることを示している。本研究の要介護度が高い者で肺炎リスクが高かったことは，まさしくこのことを示唆している。

一方で，開口保持や咀嚼運動といった口腔機能が肺炎リスクと有意に関係していたことは，開口を保持できるだけの筋力や咀嚼運動を可能とする筋の協調性が保たれていることが，肺炎予防につながることを示唆しているものと考える。実際，不適切な食形態が誤嚥や誤飲の原因となっていることが報告されていたり[8]，咀嚼運動の主体をなす舌運動の低下と食事時のむせといった嚥下障害の症状と関係していることが示されているなど[9]，安全な摂食には，口腔機能に応じた食事形態の提供が，不可欠である。

さらに，舌運動の低下しているもので舌苔が付着しやすいといった報告[10]からもわかるように，口腔機能の低下が口腔の自浄能を低下させ，口腔細菌の増加を導いている可能性もある。実際，歯周病菌が誤嚥性肺炎の有力な起炎菌であるといわれているにもかかわらず[11]，現在歯数と誤嚥性肺炎の発症との間には有意な関係は認められておらず[12,13]，残存歯数やその植立状態といった形態学的な問題に加えて，自浄能の低下による食物残渣の増加といった口腔環境を劣悪にする因子として口腔機能をとらえておく必要があるものと思われる。

しかしながら，これまでのところ，このような口腔機能の評価方法は確立されておらず，昨年度の診療報酬改定において導入された後期高齢者在宅療養口腔機能管理料や，本年4月より介護保険に導入予

表3　診査したアセスメント項目ごとの誤嚥リスク群の割合

		誤嚥リスク群(%)	対照群(%)	χ^2値	p値
要介護度	要介護度1,2,3	9名（10.5）	77名（89.5）	40.10	0.000
	要介護度4,5	47名（54.7）	39名（45.3）		
気管チューブ	留置なし	54名（31.8）	116名（68.2）	4.09	0.043
	留置あり	2名（100）	0名（　0）		
経管栄養	なし	38名（25.1）	113名（74.9）	29.71	0.000
	あり	18名（85.7）	3名（14.3）		
口腔ケアの自発性	なし	40名（52.6）	36名（47.4）	22.63	0.000
	時々ある，いつもある	14名（16.9）	69名（83.1）		
座位保持	可能	28名（23.3）	92名（76.7）	18.90	0.000
	困難，不可能	28名（58.3）	20名（41.7）		
頸部可動性	十分	25名（20.7）	96名（79.3）	28.66	0.000
	不十分，不可	28名（65.1）	15名（34.9）		
開口保持	可能	31名（22.6）	106名（77.4）	38.29	0.000
	困難，不可能	25名（80.7）	6名（19.3）		
口腔内での水分保持	可能	30名（19.2）	84名（80.8）	32.72	0.000
	困難，不可能	33名（66.0）	17名（34.0）		
含嗽	可能	19名（19.6）	78名（80.4）	26.56	0.000
	困難，不可能	35名（60.3）	23名（39.7）		
咀嚼運動	咀嚼運動できる	21名（18.1）	95名（81.9）	36.89	0.000
	上下運動のみ，できない	25名（61.0）	16名（39.0）		

欠損値を除く。χ^2検定

定である口腔機能維持管理加算を今後推し進めていくうえでは，口腔機能を評価することがきわめて重要と思われる。現在われわれは，介護現場でのカンファレンスへの参加を図っており[14]，この際，口腔機能の的確なアセスメントやリスク評価に基づくケア計画の立案，実施，再評価という，PDCAサイクル（Plan, Do, Check, Action）[15,16]に則った多職種協働型の口腔ケア・マネジメントを確立することが必要であると考えている。本研究で用いたスクリーニングシートやアセスメントシートはこのような考えのもと作成したものの，本研究では，アセスメント項目の評価基準の基準化を行っていなかったため，判断が難しい場合などに評価が抜け落ちて欠損値につながった可能性も考えられる。したがって，今後評価基準の統一化やマニュアル化を図りながら，PDCAサイクルに基づく口腔ケア・マネジメントの確立を図っていく予定である。

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表4　ロジスティック回帰分析により肺炎リスクと有意な関係のあったアセスメント項目

	推定係数	標準誤差	Wald統計量	有意確率
要介護度	0.751	0.291	6.648	0.010
経管栄養	−1.007	1.122	0.806	0.369
口腔ケアの自発性	0.549	0.627	0.767	0.381
座位保持	0.768	0.866	0.786	0.375
頸部可動性	−0.271	0.739	0.134	0.714
開口保持	1.811	0.870	4.382	0.037
口腔内での水分保持	−3.300	9.088	0.132	0.716
含嗽	−0.049	0.852	0.003	0.954
咀嚼運動	1.239	0.585	4.421	0.035
定数	−7.033	2.082	11.410	0.001

肺炎リスク群39名，対象群84名分のデータより分析。欠損値49名あり。

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Selection of Essential Assessment Items for Oral Care Management

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Essential assessment items to identify the risk of aspiration pneumonia are essential for oral health care management. In this study, the risk group for pneumonia was selected by the developed screening method among 172 institutionalized elderly (46 male and 126 female, mean age 84.0 y). The risk group consisted of 18 male and 36 female (mean age 84.0 y) who were significantly dependent and who could not keep opening their mouths or perform rhythmical chewing compared with the others ($p<0.05$). It may be concluded that assessment of oral function is the key for oral health care management.

Key words : dependent elderly person, oral health care, screening, assessment

—— 調査報告 ——

介護老人福祉施設における口腔ケア・マネジメントの効果

Efficacy of the Management of Oral Health Care on the Nursing Home

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抄録：本調査は，介護老人福祉施設における歯科衛生士による口腔ケア・マネジメントの有効性を明らかにすることを目的とした。

対象は，山梨県にある介護老人福祉施設に入居中の要介護高齢者142名で，A施設は82名（平均年齢85.9±7.5歳），B施設は60名（平均年齢85.6±8.3歳）である。調査期間は8カ月で，初回，4カ月後，8カ月後において口腔衛生状態の視診と口腔内細菌数の測定を行った。A施設では，歯科衛生士による口腔ケアの直接的介入を対象者20名に対して行い，他の対象者に対しては口腔ケアに関する情報提供と相談のみ行った。B施設では，歯科衛生士が口腔ケア・マネジメントの手法を用い，すべての対象者に対して個々のスクリーニング，アセスメントに応じたケアプランをたて，施設職員とともに口腔ケアの介入を行った。また今回の口腔ケア介入終了時に各施設職員へ意識調査のアンケートを行い，施設間の比較を行った。

その結果，A施設では，施設全体において口腔内総細菌数には変化はなかった。B施設では，介入期間中に有意に減少を示した（$p<0.05$）。職員の意識調査の結果では，A施設よりもB施設のほうが，口腔ケアに自分でも積極的に参加したいという意識や，今回の事業があまり負担ではなかったという意識がうかがわれた。

本研究の結果より，口腔ケア・マネジメントは，施設の状況，歯科衛生士の介入方法などを含めて全員に対してプランをたてていくことで効果があることが示され，本介入調査により口腔ケア・マネジメントの重要性が確認された。

キーワード：口腔ケア・マネジメント，口腔内細菌，要介護高齢者，介護老人福祉施設，歯科衛生士

緒　言

現在わが国では，多くの介護施設や病院において，口腔ケアの専門家である歯科衛生士が配置されておらず，現場への供給が不足している状況にある[1]。要介護高齢者にとって質の高い口腔ケアが必要とされている[2,3]にもかかわらず，その専門家で

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表1　対象者の概念

	介護度					障害老人の日常生活自立度							認知症老人の日常生活自立度							
	1	2	3	4	5	J1	A1	A2	B1	B2	C1	C2	正常	I	IIa	IIb	IIIa	IIIb	IV	M
A群：施設A 82名	6	10	29	29	8	2	0	21	29	15	7	4	2	15	15	8	23	16	3	0
A'群：施設A 直接介入対象者	1	4	5	9	1	1	1	5	6	3	3	1	0	2	2	4	8	2	2	0
B群：施設B 60名	1	2	12	28	17	1	0	5	13	15	7	22	1	5	5	14	10	12	22	1

（名）

ある歯科衛生士は不足し，しかも施設職員のみでは対応が不十分という報告もされている[4]。要介護高齢者では誤嚥性肺炎の発症者が多いという実態[5]があるが，口腔ケアによりこの肺炎を予防することは可能とされており[6,7]，口腔ケアは社会的にも求められている重要な課題である。

口腔衛生管理が十分に行えない要介護高齢者に対しては，限られた人的資源や社会資源のなかでう蝕や歯周疾患の予防を達成し，さらには気道感染をも予防する質の高い多職種協働の口腔ケアを提供できる体制づくりが必要である。歯科衛生士が直接，口腔清掃を行うといった従来型の口腔ケアを行っている限り，口腔ケアを必要としているすべての人たちに対応することは不可能であると考えられる。そこで歯科衛生士が個々の対象者の口腔内状況などをアセスメントし，アセスメント結果に応じた口腔ケアプランを立案し，多職種協働で口腔ケアの実施にあたるといった，口腔ケア・マネジメント[8]の手法を取り入れ，介入調査を行うことを計画した。

また，要介護高齢者の口腔ケアを直接担っている介護職員の意識調査を行い，口腔衛生状態の変化と関連があるかについても調査したいと考えた。

以上のことより，本調査は2つの介護老人福祉施設において異なる方法で口腔ケアの介入を行い，これらを比較することにより，口腔ケア・マネジメントの有効性を明らかにすることを目的として行った。

対象と方法

1．対　象

対象は，山梨県にある2カ所の介護老人福祉施設に入居中の要介護高齢者142名で，それぞれA施設82名（平均年齢85.9±7.5歳，男性23名，女性59名），B施設60名（平均年齢85.6±8.3歳，男性12名，女性48名）である。なお，A施設においては歯科衛生士が直接口腔ケアを介入して実施するために，20名（平均年齢85.9±7.3歳，男性5名，女性15名）を任意に抽出した。

対象者の主たる疾患は，脳血管疾患と認知症はいずれの施設においても多く，対象者の過半数を占めていた。要介護度，厚生労働省による障害老人の日常生活自立度，認知症老人の日常生活自立度については表1に示した。

2．方　法

調査は平成19年7月から平成20年3月の間に，初回，4カ月後，8カ月後の3時点において，順次行った。なお，「初回」は口腔ケアの介入前にケアプランを立案するために，「4カ月後」はそれまでの介入効果をもとにケアプランを再計画するための中間モニタリングとして，「8カ月後」は介入後の評価として行った。

はじめに，対象者の居住する施設に歯科医師，歯科衛生士が出向き，口腔衛生状態のアセスメントを行った。アセスメント指標は，口腔内診査と口腔内細菌である。これらのアセスメントは，歯科医師および，歯科医師の指示のもとに歯科衛生士が行った。口腔内診査については施設職員にも判断しやすい簡易なものとし，口臭は，「ない」，「弱い」，「著しい」，とした。舌苔はGomezら[9]の基準を参考に，「ない」，「薄く一部」，「薄く全体」，「厚く全体」，とした。細菌培養については，被検体の採取は被検者を開口させ，下顎第一大臼歯相当部の舌背中央部よりスワブにて採取した。7 mlの0.1 Mマニトール溶液で被検体を適宜希釈し，スパイラルプレーター（Autoplate 4000，Spiral Biotech）にて血液寒

天培地（MP-23，栄研器材）に塗布した。嫌気培養にて37℃ 48時間培養後，自動コロニーカウンター（aColyte, Synbiosys）にてカウントしたコロニー数から，検体中の細菌濃度を求めた。

また機能面では，うがいの可否，口腔ケアの自立程度や，食事中のむせや食べこぼしなどの摂食・嚥下機能についてもスクリーニング調査を行い，ケアプランの立案に役立てた。

介入方法を以下に示す。なお，介入した歯科衛生士は，施設での口腔ケアを専門とする経験年数20年以上の者とし，それぞれの施設に各3名専従で介入した。

A施設では，従来型のかかわりである歯科衛生士による直接介入の効果について，直接介入対象者と施設利用者全員の変化を検討した。ここでの直接介入とは，歯科衛生士が20名の対象者に対し，機械的口腔清掃と，含嗽やブラッシングを促すなどの口腔ケアの自立への支援である。直接介入対象者を20名とした理由は，1名の歯科衛生士が1名の対象者に対して20分間口腔ケアを実施するとして，1日に可能な人数が6～7名であることから，この人数に規定した。なお，直接介入における口腔ケアでは，器質面へのアプローチとして歯面の清掃には歯ブラシ，ラバーカップ，歯間ブラシ，デンタルフロスを用いてProfessional Mechanical Teeth Cleaning（以下，PMTC）を行い，舌・口蓋・頬粘膜などへの粘膜清掃にはスポンジブラシや舌ブラシを用いて行った。また，義歯使用者においては義歯用ブラシと義歯洗浄剤を用いた。直接介入対象者20名以外においては，施設職員が行っている口腔ケアをそのまま継続とした。施設職員の日常の口腔ケアでは，自立者は本人の意思に任せて関与しておらず，非自立者においては歯のある者では朝食後と就寝前の2回，歯のない者では就寝前の義歯清掃のみを行っている状況であった。

B施設では，口腔ケア・マネジメントの効果について施設利用者全員の変化を検討した。口腔ケア・マネジメントでは，アセスメント，ケアプランの策定，ケアの実行，再評価といった一連の流れを，口腔ケアの質のコントロールを図るために行った。一連の流れを図1に，アセスメントに用いた表を図2に示す。歯科医師および歯科衛生士が，この表を用いて評価し，その結果に基づき，対象者を低リスク者，中リスク者，高リスク者の3段階に分類した。分類の指標は，高橋ら[8]の口腔ケアに対する歯科医療職関与の必要度から，口腔内診査において，プラークの付着，舌苔の付着，口臭の項目について非常に不良な状態をひとつでも有し，さらに歯周ポケットや歯の動揺度，食物残渣や，義歯使用者においては義歯の清掃程度等の状態，摂食・嚥下機能を考慮して検討した。その後，中リスク者，高リスク者においてはさらに個別のアセスメントを行い，清掃面や機能面での問題の他，ケアの受容など心理面での問題に対応したケアプランを作成した。口腔ケア・マネジメントにおける口腔ケアの担当者は，看護職，介護職であり，一部の高リスクであると考えられた者に対する口腔ケア以外は，看護職，介護職が行うモデルを構築した。高リスク者に対しては，個別のケアプランに従い，歯科衛生士が1名につき週1回，20分間，口腔ケアを担当した。その際，器質面へのアプローチではPMTCを中心とした機械的口腔清掃と，義歯使用者には義歯用ブラシと義歯洗浄剤を用いた清掃を行い，機能面へのアプローチとして口腔関連筋の自動運動やマッサージ，唾液腺マッサージを行った。なお，口腔ケアの自立程度に合わせ，支援した。他の日常の口腔ケアは施設職員が担当した。

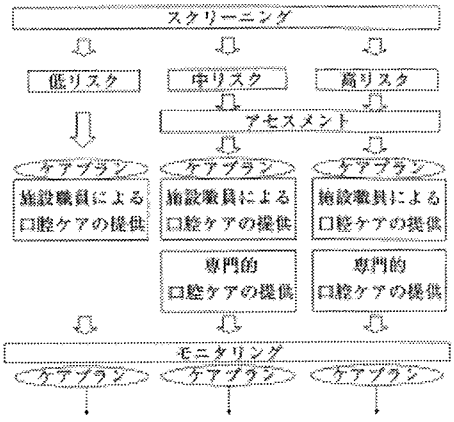

図1　口腔ケア・マネジメントの流れ