

## Research Article

# Factors Affecting the Selection of Denture Adhesive or Oral Moisturizers by Wearers of Maxillary Complete Dentures

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Submitted: 24 August 2017

Accepted: 27 September 2017

Published: 30 September 2017

ISSN: 2333-7133

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**OPEN ACCESS****Keywords**

- Complete denture
- Denture adhesive
- Oral moisturizer

**Abstract**

No previous study has clarified the experience of using adhesives/moisturizers by comparing them to subjective evaluations of patient satisfaction.

In an ultra-aged society, most elderly individuals experience many oral problems. Particularly, xerostomia and mal adaptation to dentures may lead to poor retention of maxillary complete dentures. Many patients use denture adhesives; however, the effects of these adhesives on denture cleaning and denture function are not well understood in many cases. Therefore, oral moisturizers are often recommended instead of denture adhesives. The purpose of this study was to clarify the selection criteria for denture adhesives or oral moisturizers in wearers of maxillary complete dentures.

Twenty-five maxillary edentulous subjects were enrolled in this study. A denture adhesive and three oral moisturizers (liquid, gel, and spray) were administered for 3 days each. Patients were surveyed after each treatment ("the after-use questionnaire") and at the end of the study ("the final questionnaire").

In the after-use questionnaire, the denture adhesive was evaluated highly for "stability," "chewing," "fitting," and "retention" ( $P < 0.05$ ). On the final questionnaire, the denture adhesive was selected by 14 and the oral moisturizers by 11 of 25 subjects. Patients who selected the denture adhesive evaluated its "stability" and lack of an "uncomfortable feeling" highly; patients who selected the oral moisturizers evaluated the lack of a "dry feeling" highly ( $P < 0.05$ ).

These results suggest that "stability," an "uncomfortable feeling," and a "dry feeling" were the driving criteria in choosing either the denture adhesive or an oral moisturizer.

**INTRODUCTION**

Japan is a super-aged society; the elderly population is expected to peak in 2025. Patients wearing dentures requiring nursing care and the elderly living at home who cannot easily visit a dentist have various oral problems, including ill-fitting dentures and dry mouth, which often make denture retention difficult. Adhesives improve [1] denture retention by increasing saliva viscosity between the denture's mucosal surface and the residual ridge mucosa, when hydrated by saliva and water. However, it is very difficult to remove adhesives from the oral mucosa, and there is a high risk of the mouth becoming a breeding ground for bacteria if adhesive remains [2,3]. Therefore, use of an oral moisturizer instead of an adhesive has been recommended. Different moisturizers are used in accordance with different methods and properties. A gel-type moisturizer has excellent

sustained moisturizing power and spray-type and liquid-type moisturizers are suited for ease of use and travel.

Objective comparisons regarding denture retention, oral dryness, and others have been performed between adhesives and moisturizers, but few studies have compared subjective patient satisfaction, the experience of using adhesives/moisturizers, and other pertinent factors.

In this study, we aimed to uncover factors affecting choice in selecting adhesives or moisturizers with a sample of patients wearing maxillary complete dentures.

**MATERIALS AND METHODS****Summary**

Three retention measurements and three oral dryness

tests were performed at the first visit. One adhesive and three moisturizers were distributed for home use; subjects answered a survey about their experiences using these products. At the second visit, an additional survey was administered (hereinafter, "the final questionnaire") on which product the patients ultimately wanted to use.

## Subjects

This study was approved by the ethics committee of Showa University School of Dentistry (approval number 2013-043) and written informed consent was obtained from all subjects. The subjects were 33 recalled patients (10 men, 23 women;  $80.2 \pm 6.5$  years old) who wore maxillary complete dentures that did not require adjustment [4,5]. Exclusion criteria eliminated patients with residual roots, mucosal abnormalities, those incapable of self evaluation because of dementia or other factors, and those with a history of adhesive or moisturizer use.

## Adhesives and moisturizers

One type of adhesive (New PoligripSa; Glaxo Smith Kline, Tokyo, Japan) and three types of moisturizers (gel: Biotene Oral Balance Gel; T&K, Tokyo, Japan [sale presently discontinued]; liquid: Oral Balance Liquid; T&K, Tokyo, Japan; spray: Wet Care; Kissei Pharma Ceutical, Nagano, Japan) were used.

## Method of use

**Adhesive:** After thoroughly washing the denture's mucosal surface with water and drying it completely with tissue, cream adhesive was applied to the left and right sides of the residual ridge, corresponding to the first and second bicuspid of the denture's mucosal surface and to the center of the palate; then, the dentures were fitted. After applying finger pressure to the dentures for 10 s, patients were instructed to eat a meal and not remove the dentures during the day. Patients wore the dentures before breakfast every day for 3 days.

**Moisturizer:** Patients were instructed to wash/clean their dentures thoroughly after waking, breakfast, and dinner, and to apply moisturizer to the denture's mucosal surface. The patients applied the moisturizer three times daily for 3 days.

(1) Gel/liquid: Patients were instructed to apply 1 cm of gel/liquid to the denture's mucosal surface and spread it along the full surface using their fingers.

(2) Spray: Patients were instructed to spray the moisturizer on the full mucosal surface approximately three times.

## Testing

**Retention ability:** Retention ability was measured according to Takayama et al., method [6]. First, retention ability was measured once upon hospital arrival without removing the dentures. Next, the three moisturizers were measured six times each. The initial measurement was excluded because the viscous deformation of the mucosa was not stable. Finally, adhesive was applied and measured once. Because removing the adhesive is difficult, retention ability was measured once. Enough liquid was used to cover the entire denture's mucosal surface. Approximately 20 N of hand pressure was used to compress the dentures for 10 s inside the mouth; this pressure was measured.

The conditions for discontinuing measurements were as follows: if the measurement exceeded 20 N or if the subject complained of pain. If measurement discontinuation conditions occurred twice, the measurement was subsequently discontinued.

- **Oral dryness evaluation:** The oral dryness evaluation consisted of three tests.
- **Unstimulated salivary flow rate (cotton roll method):** A cotton roll was placed under the tongue for 60 s and then removed, and the quantity of absorbed saliva was measured. Caution was advised if the quantity was below 0.2 g in 60 s, and the patient was diagnosed with oral dryness [7].
- **Saliva wetness test:** Salivary moisture level test paper (KISO-Wet Tester, KISO Science Co., Ltd., Yokohama, Japan) was placed vertically on the mucosa of the tongue and held there, and the part to where the moisture penetrated was read during a period of 10 s. Salivary moisture was evaluated as decreased (less than 1 mm), mildly decreased (1–1.9 mm), borderline (2–2.9 mm), or normal (3 mm or more). If the value was less than 1 mm, moisturizer or artificial saliva was required. Moreover, even for values between 1 and 2 mm, if the mucosa of the tongue felt dry, moisture was required.
- **Clinical diagnostic criteria:** After observation of the oral cavities, clinical diagnostic criteria (the Kakinoki classification) [8,9], were used to evaluate oral dryness from 0 (normal) to 4 (severe). Level 2 or 3 signified that the salivary secretion quantity required improvement and moisturizer was necessary.

## Questionnaire

Two types of surveys were conducted in this study.

**The after-use questionnaire:** The experiences of using each product for 3 days were evaluated on five levels: good, rather good, normal, rather poor, and poor. The evaluated items are shown in Table 1.

**The final questionnaire:** Subjects were asked if they wished to use again in the future the product types they selected as good and why they selected those products. The evaluated items are shown in Table 2.

## Statistical analysis

The Friedman test and Bonferroni method were used for the analysis of the after-use questionnaire. A t-test was performed for denture retention ability. For subject evaluations of products, the Wilcoxon signed-rank test was performed; for comparisons of denture and adhesive/moisturizer retention abilities [10], a Kruskal-Wallis one-way analysis of variance was performed. SPSS ver. 19 (SPSS Statistics Base 19<sup>®</sup>; IBM, Tokyo, Japan) was used for analysis [11-14].

## RESULTS

### Subjects

Of the 33 subjects, eight were excluded; data from 25 subjects (nine men, 16 women;  $79.1 \pm 7.5$  years old) were analyzed.

**Table 1:** Questionnaire administered after product usage.

1. How many times per day did you use the product?	- times
2. Taste of the product: how satisfied were you with the product's taste?	
3. Use experience: how easy was it to use the product?	
4. Dry feeling: did the product improve the feeling of dryness in your mouth?	
5. Taste of meals: was there a change in the taste of meals?	
6. Chewing: were you able to chew well?	
7. Fitting: did your dentures fit your gums well?	
8. Stability: were your dentures stable?	
9. Uncomfortable feeling: did you feel a sense of incongruity?	
10. Retention: were your dentures retained well?	
1) Very satisfied 2) Satisfied 3) Neutral 4) Dissatisfied 5) Very dissatisfied	

**Table 2:** Final questionnaire.

1. Which type of product did you like most?
1) Denture adhesive (Poligrip®)
2) Gel type (Oral Balance®)
3) Liquid type (Oral Balance®)
4) Spray type (Wet Care®)
2. Do you want to use the product that you chose in the future?
1) Extremely well 2) Very well 3) Moderately well 4) Slightly well 5) Not at all well

Reasons for exclusion were pain during retention ability measurement, inappropriate moisturizer use, feeling unwell from moisturizer use, not finishing the survey, and others.

### Retention ability

The retention ability's mean value was  $4.9 \pm 2.9$  N [15].

### Oral dryness evaluation

#### Unstimulated salivary flow rate (cotton roll method):

Fifteen subjects had values of 0.2 g/60 s or higher; 10 subjects had lower values. A significant difference was not observed.

#### Saliva wetness test:

Four patients had mildly decreased saliva wetness, 13 patients had borderline, and eight patients had normal. No subject showed decreased saliva wetness.

#### Clinical diagnostic criteria:

Eleven patients had a score of 0 (normal) and 14 patients had a score of 1 (mild). There was no subject with a 2 (moderate) or 3 (severe) score.

### Denture retention ability, salivary secretion quantity, and oral dryness

The effect of oral dryness on denture retention ability was investigated during use. The unstimulated salivary flow rate, saliva wetness test, and clinical diagnostic criteria did not affect the denture retention ability results [16].

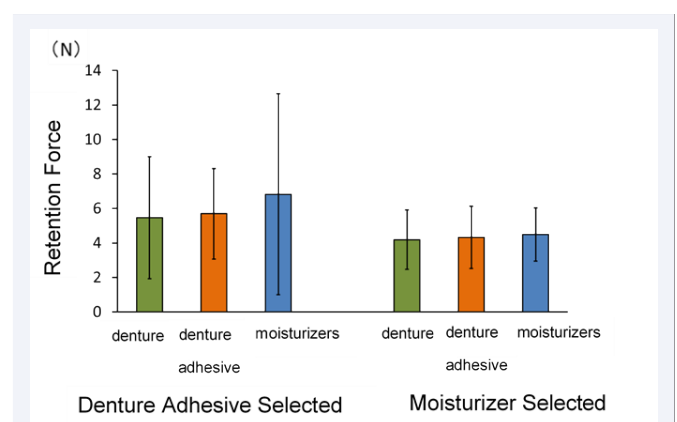
### Comparison of the retention ability of each selected product

Comparisons of the denture retention abilities of the selected adhesive and moisturizers were performed (nothing applied versus adhesive or moisturizer applied) using the final questionnaire results [17]. Neither the retention ability of the

current dentures nor the retention ability measured when using the adhesive or moisturizers affected patient preference (Figure 1).

### Questionnaire

**The after-use questionnaire:** An after-use questionnaire was completed for each product. Moisturizers tended to be evaluated as slightly poorer or poorer than the adhesive in terms of "product taste," and the spray-type moisturizer tended to be evaluated as poor. Regarding "use experience," there was no significant difference between the adhesive and liquid groups ( $P > 0.05$ ) (Figure 2). Regarding "chewing" and "fitting," most subjects responded that the adhesive was better than or rather better than the liquids or spray (Figure 3, Figure 4). Regarding



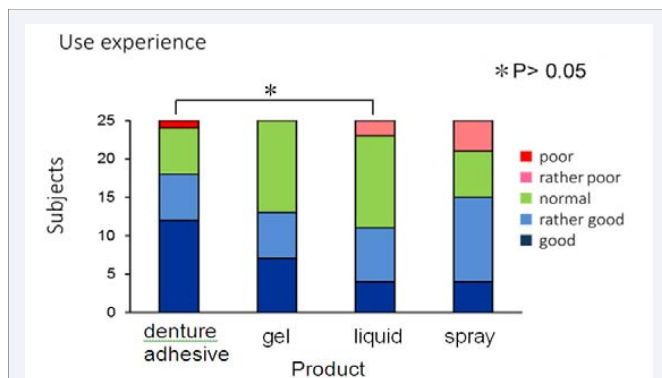
**Figure 1** A comparison of retention force between those selecting denture adhesive and those selecting moisturizers. A significant difference was not observed.

“retention” and “stability,” most subjects preferred the adhesive to the liquids or spray (Figure 5, Figure 6).

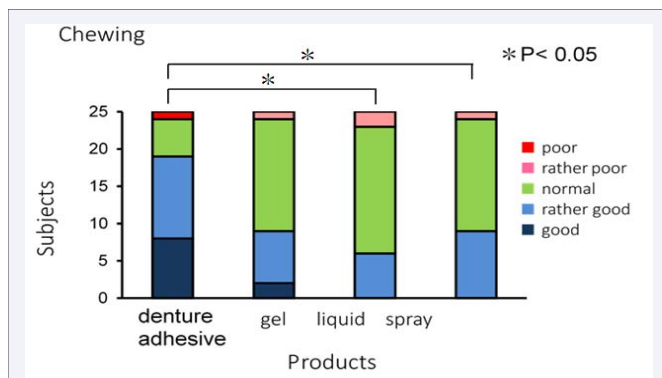
**The final questionnaire:** Ultimately, 14 patients selected the adhesive and 11 selected the moisturizers (gel = 9; liquid = 1; spray = 1). Regarding intention for future use, the answers of subjects who selected the adhesive were widely distributed from “wish to use” to “do not wish to use”; most subjects who selected the moisturizer responded that they “wished to use it on occasion” (Figure 7).

The number of subjects who wished to use the products they selected for the adhesive and the oral moisturizers were equivalent. There was no significant difference between the sexes, but more men selected the adhesive; the percentages of women who selected the adhesive or a moisturizer were approximately equal.

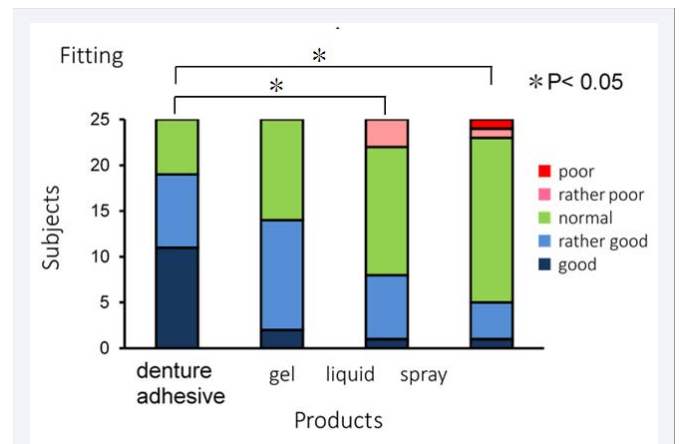
Subjects were divided into two groups according to adhesive versus moisturizer selection on the final questionnaire, and each item on the after-use questionnaire was analyzed. Most subjects who selected the adhesive felt that their dentures were more stable and caused no discomfort when the adhesive was used versus a moisturizer. Most subjects who selected a moisturizer felt there was less dryness with a moisturizer than with the adhesive (Figure 8).



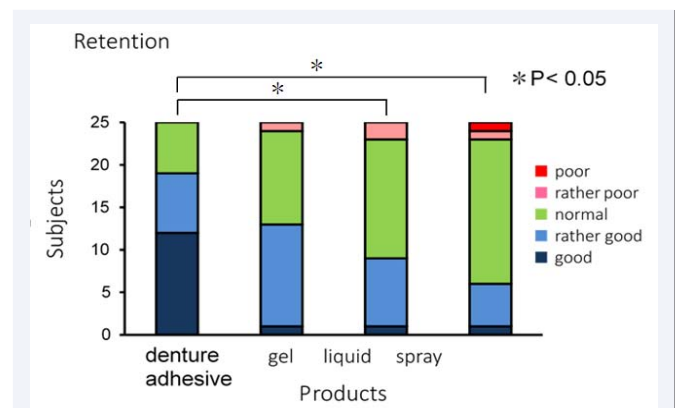
**Figure 2** Questionnaire results from after product use. In terms of the “use experience,” there was no significant difference between the adhesive group and the liquid group ( $P > 0.05$ ).



**Figure 3** Questionnaire results after product use. In terms of “chewing,” most subjects responded that the adhesive was better than or rather better than the liquids or spray.



**Figure 4** Questionnaire results after product use. In terms of “fitting,” most subjects responded that the adhesive was better than or rather better than the liquids or spray.



**Figure 5** Questionnaire results from after product use. In terms of “retention,” most subjects responded that the adhesive was better than the liquids or spray.

## DISCUSSION

In this study, typical gel, liquid, and spray moisturizers were used. Yamagaki et al., found that as moisturizer viscosity increased, retention ability increased [18]; so, a product with an average viscosity was selected. Moreover, highly viscous moisturizers were capable of substituting for an adhesive.

The moisturizer quantity was determined according to previous reports. Kawazoe et al., found that the retention ability decreased if there was too much or too little saliva between the denture base and the underlying mucosa; they contended that there is an appropriate amount of product based on each individual’s saliva amount [19]. Yamagaki et al., found that if test samples were covered on all model surfaces, retention ability could be stably measured [18]. Therefore, the adhesive quantity was set as the amount completely covering the basal denture mucosa surface.

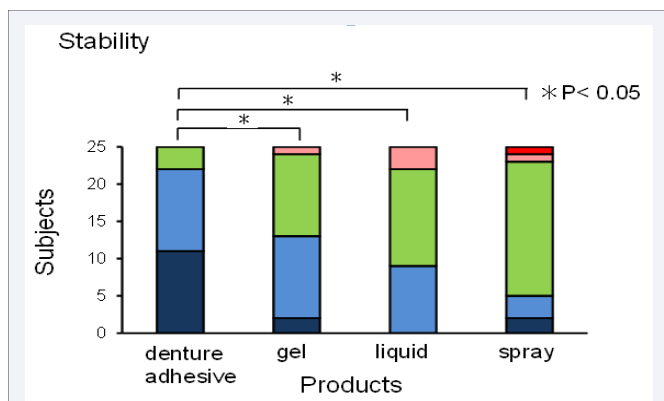
## Tests

**Retention ability:** To determine the retention ability required for routine use, it was measured when the subject

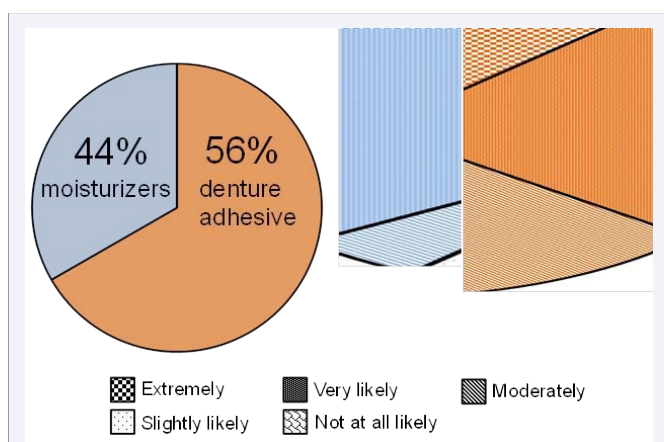
was at rest (not eating, drinking, or gargling). The conditions of the mucosa and the denture changed when the denture was removed; because this was believed to differ from routine use, this measurement was performed once. Because it was difficult to remove denture adhesive from the mucosal surface and to place a certain amount between the denture base and the underlying mucosa, only one measurement was performed after the moisturizer measurements were finished. To rule out saliva effects, the first moisturizer measurement was excluded, and five retention ability measurements were used. The gel had significantly greater retention ability than the adhesive. A moisturizer was able to increase retention for a short period.

**Saliva secretion quantity and oral dryness:** Unstimulated salivary flow rates were evaluated as the quantity of saliva per unit time. Kakinoki et al. [20], found that evaluating the quantity of saliva, clinical diagnostic criteria, dryness of the oral mucosa, and moisturization status was clinically meaningful.

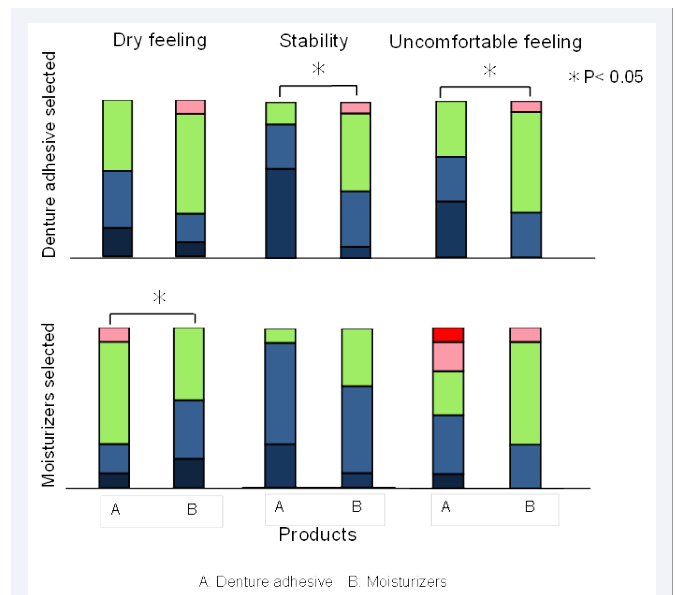
No subject in this study had moderate-to-severe oral dryness, so the effect of oral dryness on the subjective/objective evaluation was believed to be slight.



**Figure 6** Questionnaire results after product use. In terms of “stability,” most subjects responded that the adhesive was better than the liquids or spray.



**Figure 7** Results from the final questionnaire. Ultimately, 14 patients selected the adhesive and 11 patients selected moisturizers (gel, nine patients; liquid, one patient; spray, one patient).



**Figure 8** Comparison questionnaire assessed after product use between those who selected denture adhesive and those who selected moisturizers on the final questionnaire.

## Questionnaire

Many studies have examined factors affecting satisfaction, in which patients were asked to use adhesives or moisturizers. Sato et al. [21], analyzed data from a satisfaction questionnaire, developed a satisfaction score, and performed various subjective and objective evaluations. Another study conducted a survey on subjective symptom improvement when a moisturizer was used in patients with oral dryness [22]. However, few reports have compared and studied subjective evaluations of patients who used adhesives and moisturizers.

**The after-use questionnaire:** In terms of chewing, fitting, retention, stability, and other functions, adhesives were more highly evaluated than liquids or sprays, with no significant difference between the adhesive and the gel moisturizer. This is possibly because the gel moisturizer has retention ability similar to that of an adhesive [21].

When subjects were divided based on adhesive versus moisturizer selection on the final survey, subjects who selected the adhesive were most concerned with improvement in denture function, such as stability and an uncomfortable feeling; those who selected a moisturizer were believed to be expecting improvement in the feeling of dryness.

**The final questionnaire:** Regarding the reason for selecting an adhesive or a moisturizer, most subjects were satisfied with the adhesive’s fitting and function, and subjects selected a moisturizer for ease of use, improvement in dryness, and so on.

Possibly, the number of people who wished to continue using the products they selected was similar for the adhesive and the moisturizers because few factors affected the selection of the two choices; for example, subjects were satisfied with their present dentures and few had dryness complaints. Future investigations should be conducted in a larger number of subjects regarding how

denture shapes and function and how the shape of the residual ridge affects patients' choices of adhesives and moisturizers [23].

## CONCLUSION

When patients who selected an adhesive versus a moisturizer were compared, those selecting the adhesive regarded it highly for its stability and lack of discomfort, and those selecting a moisturizer regarded it highly for its improvement of dryness.

These results suggest that stability, an uncomfortable feeling, and a sense of dryness were involved in the selection of a denture adhesive or moisturizer.

## ACKNOWLEDGEMENTS

We would like to thank all those from the Showa University Department of Geriatric Dentistry for the cordial supervision we received throughout the study, as well as express our gratitude for the helpful advice provided by Professor Koji Takahashi from the Department of Special Needs Dentistry, Division of Oral Rehabilitation Medicine; Professor Shouji Hironaka from the Department of Special Needs Dentistry, Division of Hygiene and Oral Health; and Associate Professor Takeshi Sukanuma from the Department of Prosthodontics. We would like to express our deepest appreciation to the subjects who participated in this study. This study was subsidized by the 2014-2016 Grant-in-Aid for Scientific Research (Fundamental Research (c) Topic No. 26462938).

## REFERENCES

1. Kawai Y. The right denture adhesives. *Quintessence*. 2014; 39: 50-56.
2. Harada-Hada K, Hong G, Abekura H, Murata H. Evaluation of the efficiency of denture cleaners for removing denture adhesives. *Gerodontology*. 2016; 33: 453-460.
3. Chen F, Mao T, Cheng X. pH and effects on *Streptococcus mutans* growth of denture adhesives: an *in vitro* study. *Gerodontology*. 2014; 31: 95-100.
4. Ichikawa T, Sato H, Kuboki T, Sato Y, Hideshima M, Tomotake Y, et al. Classification system for the completely dentate, partial and complete edentulism. *Dent Jpn*. 2006; 42: 209.
5. McGarry TJ, Nimmo A, James FS, Ahlstrom RH, Smith CR, Koumjian JH, et al. Classification system for complete edentulism. *J Prosthodont*. 1999; 8: 27-39.
6. Takayama M, Sato Y, Kitagawa N, Nakatsu M, Yamagaki K, Aoyagi K, et al. The effects of viscosity of oral moisturizers and residual ridge form on the retention force of maxillary complete dentures. *JSM Dentistry*. 2015; 4: 1077.
7. Kawazoe Y, Hamada T, Yamada S. Studies on the retention of dentures. Part 4. Changes of intervening salivary volume during tapping movement. *J Jpn Prosthodont Soc*. 1976; 20: 148-152.
8. Kakinoki Y. Evaluation method of salivary secretion and oral dryness. Oral dryness and oral care useful in nursing. *Ishiyaku Pub*. 2005; 8-75.
9. American Dental Association Council on Dental Research and Council on Dental Therapeutics. Dental relining materials for home use. *J Am Dent Assoc* 1933; 47: 214-215.
10. Munoz CA, Gendreau L, Shanga G, Magnuszewski T, Fernandez P, Durocher J. A clinical study to evaluate denture adhesive use in well-fitting dentures. *J Prosthodont*. 2012; 21: 123-129.
11. Means CR. A study of the use of home reliners in dentures. *J Prosthet Dent*. 1964; 14: 623-634.
12. Means CR. A report of the use of home reliner materials. *J Prosthet Dent*. 1964; 14: 935-938.
13. Means CR. The home reliner materials: the significance of the problem. *J Prosthet Dent*. 1964; 14: 1086-1090.
14. Lytle RB. Do it yourself prosthodontics. *Dent Progr*. 1964; 1: 221-222.
15. Kakuda T, Sato Y, Kitagawa N, Nakatsu M, Aoyagi K, Takayama M, et al. Examination of optimal sites and loading methods for measuring maxillary complete denture retention. *Jpn J Gerodont*. 2015; 30: 25-36.
16. Östlund SG. Saliva and denture retention. *J Prosthet Dent* 1960; 10: 658-663.
17. Kumar MS, Thombare RU. A comparative analysis of the effect of various denture adhesives available in market on the retentive ability of the maxillary denture: an *in vivo* study. *J Indian Prosthodont Soc*. 2011; 11: 82-88.
18. Yamagaki K, Kitagawa N, Sato Y, Okane M, Mashimo J. The relation between the physical properties of oral moisturizer and denture retention force. *Rōnen Shika Igaku*. 2011; 26: 402-411.
19. Kawazoe Y, Hamada T, Yamada S. Study of denture retention, 3rd report, change in the quantity of saliva between the denture base and underlying tissues and separation force. *Ann Jpn Prosthodont*. 1975; 19: 289-293.
20. Kakinoki Y. Pathology and treatment of oral dryness. *Ann Jpn Prosthodont Soc*. 2015; 7: 136-141.
21. Sato Y, Hamada S, Akagawa Y, Tsuga K. A method for quantifying overall satisfaction of complete denture patients. *J Oral Rehabil*. 2000; 27: 952-957.
22. Furumoto EK, Barker GJ, Carter-Hanson C, Barker BF. Subjective and clinical evaluation of oral lubricants in xerostomic patients. *Spec Care Dentist*. 1998; 18: 113-118.
23. Ishibashi S, Sato Y, Kitagawa N, Hara S, Hosono Y, Ishihara H. A study on the clinical utility of a scale for examination in residual ridge. *Ann Jpn Prosthodont Soc*. 2009; 1: 157-165.

### Cite this article

Tsubakida K, Sato Y, Kitagawa N, Nakatsu M, Kana T, et al. (2017) Factors Affecting the Selection of Denture Adhesive or Oral Moisturizers by Wearers of Maxillary Complete Dentures. *JSM Dent* 5(3): 1099.