Abstract: The purpose of this study was to clarify the usage and understanding of denture adhesives among 1,825 denture wearers, aged 40 years and older in Japan, using a web-based survey. The NTTCom Online survey (a closed investigation) was conducted over a period of 4 days using a 13-item questionnaire about denture adhesives. Results showed that 67.1% of the respondents were satisfied with their dentures; 81.5% of respondents knew about denture adhesive, but only 347 (19.0%) had used the product. Products used by the 347 denture wearers included cream type (79.7%), cushion type (16.2%), and powder type (3.2%). The most common reason for the selection of a particular type was “Saw the product” (59.9%), followed by “Saw an advertisement” (19.3%), and “Explanation at a dental clinic” (8.4%). The response of “Ill-fitting denture” significantly affected the response of “Use of denture adhesives” (chi-square test; P < 0.001). Moreover, the sensitivity (0.56) was lower than the specificity (0.75). These findings show that denture adhesives were not always necessary for those with ill-fitting dentures.

Keywords; denture adhesive, denture wearers, marketing behavior, web-based survey

Introduction

The U.S. Food and Drug Administration (FDA) advises denture wearers that a large amount of denture adhesive will not necessarily address problems associated with ill-fitting dentures and that prolonged use of ill-fitting dentures may lead to an increase in bone loss (https://www.fda.gov/medical-devices/dental-devices/denture-adhesives). In recent years, as denture wearers have learned proper denture adhesive use (especially of the cream type) under the guidance of dentists, they have acquired denture retention and stability and have gained more satisfaction with the product [1-8].

Denture adhesives are pastes, powders, or adhesive pads that may be placed in/on dentures for tight adhesion (https://www.fda.gov/medical-devices/dental-devices/denture-adhesives). Adhesives differ significantly from cushion-type items such as home-pliers; yet cushion-type items may be confused for denture adhesives by denture wearers in Japan. Denture adhesives are mainly composed of carboxymethyl cellulose sodium and expand along the interface between the denture surface and the mucous membrane, adhering to both sides without influencing the occlusal relationship. However, the fact that denture adhesives are difficult to remove may lead to sanitary problems. Home-pliers are mainly composed of polyvinyl acetate and fill the space caused by ill-fitting dentures, negatively affecting the occlusal relationship. While these two denture-realted items have significantly different comfort levels and health effects experienced by denture wearers, the use and understanding of denture adhesives among denture wearers remain unknown.

Dentists do not routinely instruct all denture wearers on how to use denture adhesives. Therefore, the purpose of this study was to clarify the usage and understanding of denture adhesives among denture wearers aged 40 years and older in Japan using a web-based survey.

Materials and Methods

The 15 items are categorized into five different types: powder, cream, sheet, tape, and cushion. A web-based survey (a closed investigation) regarding denture adhesives was conducted among denture wearers aged 40 years and older during the period January 20–23, 2017, using a 13-item questionnaire from NTTCom Online Marketing Solutions Corporation (Tokyo, Japan) (Table 1). First, four sample questions (gender, age, profession, and denture usage) were used to extract 1,825 respondents who wore dentures. For profession, the respondents selected all choices that applied. In that case, the income of “Housewife/househusband” is a pension, she/he is also a “Pensioner.” Then, the 1,825 denture wearers were asked 13 questions, structured as follows: questions 1 to 3 concerned denture status and questions 4 to 13 denture adhesives. The denture adhesives used in this research are shown in Table 2. The authors declare that all experiments on human subjects were conducted in accordance with the Declaration of Helsinki (http://www.wma.net) and that all procedures were carried out with the adequate understanding of and written consent from all subjects. Hiroshima University Ethical Review Board approved a web-based survey without examination due to the voluntary nature of the survey, the protection of personal information, and the absence of harm guaranteed for each subject.

A chi-square test was used with BellCurve for Excel and Windows, ver. 3.20 (Social Survey Research Information Co., Tokyo, Japan) to statistically evaluate the relationships between “Ill-fitting denture” and “Use of denture adhesives” and between “Use of denture adhesives” and “Feelings in response to price of denture adhesives” (P < 0.05). An independent chi-square test was also performed to verify the independence of “Ill-fitting denture,” “Knowledge of denture adhesives,” “Use of denture adhesives,” and “Selection of denture adhesive products” from sex (P < 0.05).

Results

The 1,825 denture wearers included 1,472 males (80.7%) and 353 females (19.3%). Their average age was 67.1 ± 7.5 (40-89) years (males: 67.5 ± 7.4 [41-89]; females: 65.6 ± 7.8 [40-84]). Age groups were distributed as follows: 40s (44), 50s (145), 60s (1,017), 70s (537), and 80s (82). The most common occupation was pensioner (44.7%), followed by company employee (16.2%) and housewife/househusband (12.2%).

The results of the online survey about denture adhesives are shown in Table 1. The most common type of denture (including the case of a denture wearer with two types) was lower partial dentures (63.1%), followed by upper partial dentures (54.6%), upper full dentures (13.1%), and lower full dentures (9.1%). Only 601 (32.9%) of denture wearers felt their dentures did not fit well; 1,224 (67.1%) of wearers were satisfied with their dentures. The most common complaint was discomfort (57.4%), followed by looseness (51.6%) and pain (24.6%). The survey revealed that 81.5% of the 1,825 denture wearers knew about denture adhesives, but only 347 (19.0%) had used them. The most common reason for denture adhesive use was “Ill-fitting denture” (40.5%), followed by “Adhesive use” (29.0%), and “Recommendation by a dentist” (10.6%). Sex did not significantly affect the response to question 2, “Ill-fitting denture” (P = 0.51) or the response to question 4, “Knowledge of denture adhesives” (P...
Results of the online survey about denture adhesives

Q1: Where do you wear dentures? Select all that apply. (n = 347)
1. Lower partial dentures: 1,152 (63.1%); 2. Upper partial dentures: 997 (54.6%)
3. Upper full dentures: 239 (13.1%); 4. Lower full dentures: 166 (9.1%)

Q2: Do you have any issues with your dentures? (n = 347)
1. No: 1,224 (67.1%); 2. Yes: 601 (32.9%)

Q3: What issues do you have with your dentures? Select all that apply. (n = 601)
1. Discomfort: 345 (57.4%); 2. Looseness: 319 (51.5%); 3. Pain: 148 (24.6%)

Q4: Do you know about denture adhesives? (n = 347)
1. Yes: 1,487 (81.5%); 2. No: 338 (18.5%)

Q5: Do you use denture adhesives? (n = 347)
1. No: 1,052 (70.7%); 2. Yes: 347 (23.3%); 3. I would like to: 88 (5.9%)

Q6: Why do you use denture adhesives? (n = 347; Yes)
1. Ill-fitting denture: 176 (40.5%); Yes: 158 (39.8%); I would like to: 126 (29.0%);
2. Advertisement: 126 (29.0%); Yes: 95 (27.4%); I would like to: 31 (35.2%);
3. Dentist recommendation: 46 (10.6%); Yes: 43 (12.4%); I would like to: 3 (3.4%)

Q7: What type of denture adhesive (including product name) do you use? Select the main product that you use. => See Table 2. (n = 347)

Q8: How did you choose the type of denture adhesive to use? (n = 347)
1. I saw the product in the pharmacy/drugstore/store: 208 (59.9%)
2. I saw an advertisement: 67 (19.3%)
3. I was told about it at a dental clinic: 29 (8.4%)
4. Staff at the pharmacy/drugstore/store told me about it: 23 (6.6%)
5. Recommendation from family member/friend/acquaintance: 12 (3.5%)
6. Other: 8 (2.3%)

Q9: Please select all of the dentures (including position) for which you use denture adhesives. (n = 347)
1. Lower partial dentures: 172 (49.6%)
2. Upper partial dentures: 149 (42.9%)
3. Upper full dentures: 98 (28.2%)
4. Lower full dentures: 58 (16.7%)

Q10: How long have you been using denture adhesive? (years) (n = 347)
1. < 1: 43 (12.4%); 2. 1 ≤, < 5: 171 (49.3%); 3. 5 ≤, < 10: 80 (23.1%); 4. 10 ≤: 3 (0.9%)

Q11: Did you know that there are risks associated with incorrect use of dental adhesives (change in bite, tendency of the remaining teeth to move, abnormal absorption into jaw bones supporting the dentures, bacterial and fungal infections, etc.)? (n = 347; Q5: Yes)
1. No: 1,052 (70.7%); 2. Yes: 347 (23.3%); 3. I would like to: 88 (5.9%)

Q12: Where did you learn how to correctly use denture adhesives? Please select all that apply. (n = 460)
1. Product instructions: 193 (42.0%)
2. Dental clinic: 158 (34.3%)
3. Media (newspaper, TV, internet): 143 (31.1%)
4. Pharmacy/drugstore/store: 86 (18.7%)
5. Family member/friend/acquaintance: 34 (7.4%)
6. Other: 8 (2.3%)

Q13: How do you feel about the price of denture adhesives? (n = 347; Q5: Yes)
1. Expensive: 160 (46.1%)
2. Just right: 95 (27.4%)
3. Does not matter: 65 (18.7%)
4. Cheap: 4 (1.2%)

Table 1
Results of the online survey about denture adhesives

Table 2
Denture adhesives used in this research and % of use (Q7; n = 347)

| Type     | Product                  | Principal ingredient | Manufacturer                        | % of use (Other: 0.3%) |
|----------|--------------------------|----------------------|-------------------------------------|------------------------|
| Powder   | Poligrip Powder Free    | CMC-Na*              | GlaxoSmithKline (Tokyo, Japan)     | 2.0                    |
|          | FASTON                   | Karaya gum           | Lion (Tokyo, Japan)                 | 1.2                    |
| Cream    | New Poligrip S          | CMC-Na*              | GlaxoSmithKline                    | 32.0                   |
|          | New Poligrip Free       | CMC-Na*              | GlaxoSmithKline                    | 28.2                   |
|          | New Poligrip V          | CMC-Na*              | GlaxoSmithKline                    | 6.3                    |
|          | Polident NEO Denture Adhesive | CMC-Na*                | GlaxoSmithKline                    | 8.6                    |
|          | Tough Grip Cream Free   | CMC-Na*              | Kogyoshi Pharmaceutical            | 4.6                    |
| Sheet    | Sea-Bond                | Sodium alginate      | Eisai (Tokyo, Japan)               | 0.6                    |
| Tape     | Touch Correct II        | CMC-Na*              | Shionogi Healthcare (Osaka, Japan)  | 0.0                    |
| Cushion  | Tough Grip Clear        | PVAc*                | Kogyoshi Pharmaceutical            | 4.6                    |
|          | Tough Grip Pink         | PVAc*                | Kogyoshi Pharmaceutical            | 6.1                    |
|          | Soft Tough Grip         | PVAc*                | Kogyoshi Pharmaceutical            | 0.6                    |
|          | New Liodont White       | PVAc*                | Kogyoshi Pharmaceutical            | 0.6                    |
|          | New Liodont Pink        | PVAc*                | Lion                               | 0.3                    |
|          | Cushion Correct         | PVAc*                | Shionogi Healthcare                | 4.0                    |

*CMC-Na, Carboxymethylcellulose sodium; **PV Ac, Polyvinyl acetate

(0.20). However, it did affect the response to question 5, “Use of denture adhesives” (P = 0.03).

The distribution of denture adhesive products used by the 347 denture wearers (Table 2) was as follows: cream type (79.7%), cushion type (16.2%), and powder type (3.2%). The cream-type denture adhesive supplied by GlaxoSmithKline accounted for 75.1% of the denture adhesives used. Sex did not significantly affect the response to question 7, “Selection of denture adhesive products” (P = 0.49). The most common reason for choosing a specific type of denture adhesive (n = 347; denture adhesive users) was “Saw the product in the pharmacy/drugstore/store” (59.9%), followed by “Saw an advertisement” (19.3%) and “Explanation at a dental clinic” (8.4%). The most common type of denture worn with denture adhesives was lower partial dentures (49.6%), followed by upper partial dentures (42.9%), upper full dentures (28.2%), and lower full dentures (16.7%).
53 (15.3%).

Of the 347 respondents who use denture adhesives (Q5: Yes), 197 (56.8%) did not understand the risks associated with incorrect use of denture adhesives. The 460 respondents who claimed to understand the risks learned them from “Product instructions” (42.0%), followed by “Dental clinic” (34.3%) and “Media” (31.1%).

For the results of question 13 regarding the price of denture adhesives, 46.1% of the 347 respondents answered “Expensive” and 53.9% had no complaint about the price. “Use of denture adhesives” did not affect the results of question 13 ($P = 0.06$).

For cross tabulation of question 2 for ill-fitting dentures and question 5 for denture adhesive, the result of question 2 significantly affected that of question 5 ($P < 0.001$). The sensitivity and positive predictive value were 0.56 and 0.48, respectively. The specificity and negative predictive value were 0.75 and 0.80, respectively.

**Discussion**

Web-based surveys can be conducted in a faster, cheaper, and easier manner than surveys conducted through conventional methods such as by mail or interview [9]. The use of web-based surveys in medical research has been increasing, but it has some disadvantages such as limited respondent age range and sampling error. However, web-based methods will continue to grow in importance for certain types of research surveys; they are sure to become the leading tool for sociomedical and clinical research [9]. The 1,825 respondents in this study were extracted using two-stage sampling from the NTTCom research monitor panel. As men are more likely to participate in internet surveys, there were more males (80.7%) than females (19.3%). However, the ages of the 1,825 respondents ranged from the 40s to the 80s, and the most common occupation was pensioner (44.7%). The most advanced age of respondents was 89 years old and there were 82 in their 80s. Thus, the members registered in NTTCom Online survey have sufficient knowledge to answer the questionnaire. The responses of elderly respondents in NTTCom Online survey did not necessarily lose touch with those of the elderly denture wearers without the knowledge since the knowledge cannot affect their responses. As such, these respondents must be an appropriate sample for an investigation with limitations on denture-adhesive use. A subsequent web-based survey study would need to get the same number of respondents for sex and each age group.

Dentists will be glad to learn that 67.1% of the respondents were satisfied with their dentures. For those reporting ill-fitting dentures, the most common complaints were “Discomfort” (57.4%), “Looseness” (51.6%), and “Pain” (24.6%). Although 81.5% knew about denture adhesives, only 347 (19.0%) reported using them. The products used by the 347 denture wearers included the cream type (79.7%), cushion type (16.2%), and powder type (3.2%). The most common reason for selection was “Saw the product” (59.9%), followed by “Saw an advertisement” (19.3%), and “Explanation at a dental clinic” (8.4%). It appears that advertisements strongly affected respondents’ choices of denture adhesives, as the cream-type supplied by GlaxoSmithKline accounted for 75.1% of the denture adhesives used. The questionnaire in this study did not include the period of denture use since the period of use could not affect the denture adhesive use and was not an important factor. When the denture wearers could encounter the information on denture adhesives, they would determine whether to use them or not.

The result of “Ill-fitting denture” significantly affected that of “Use of denture adhesives” ($P < 0.001$). The sensitivity (0.56) was lower than the specificity (0.75), which means denture adhesives were not always necessary for denture wearers with ill-fitting dentures. Dentists must adjust the dentures properly and instruct patients on the proper use of denture adhesives. Shigli’s [10] guidelines for the use of denture adhesives are as follows: (1) use the minimum amount necessary to achieve the desired result, (2) distribute the adhesive evenly over the tissue-bearing surfaces, (3) apply or reapply when necessary, (4) always apply denture adhesive to a clean tissue-bearing surface, and (5) schedule periodic professional oral evaluations.

Based on this web-based survey of denture adhesive use in Japan, once patients started to use denture adhesives, the long-term use could be promoted. Thus, they would greatly benefit from increased guidance from a dentist regarding the proper use of denture adhesives.

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**Conflict of interest**

The authors have no conflict of interest in relation to the companies whose products are mentioned in this article.

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