

A Clinical Evaluation Denture Adhesives Used by Patients With Xerostomia

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Abstract: The purpose of study was to analyze the participants' opinions concerning the effectiveness of 6 denture adhesives (DA).

The study group included 60 participants. Criteria for selecting the patients were as follows: reduced retention and stabilization of maxillary complete dentures and xerostomia. These features were evaluated on basis of clinical examination and standard sialometry tests (u-SFR). Retention of maxillary dentures was scored by modified Kapur index before application of DA. All participants were divided randomly into 6 groups regarding the use of the 6 DA during a 6-month period. After this time, participants completed an HRQL questionnaire.

DA noticeably improved retention and stabilization of maxillary complete dentures. DA in the glue form had the best retention effectiveness in participants with xerostomia. These materials are difficult to clean from the denture base. The data are presented in tables and figures.

The results of the study collected positive influence of adhesives on retention of dentures in xerostomia patients. The cleaning dentures and denture bearing tissues was difficult.

DA help in the use of prostheses, but it is also necessary for the treatment of the causes and symptoms of xerostomia.

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Abbreviations: DA = denture adhesives, HRQL Questionnaire = Health-Related Quality-of-Life Questionnaire, HSD = honestly significant difference—test post hoc, PAL = palatal secretion, PAR = parotid secretion, s-SFR = stimulated salivary flow rate, u-SFR = unstimulated salivary flow rate.

INTRODUCTION

Denture adhesives (DA) of dental materials are designed to improve retention and stabilization of removable prostheses. They are commonly used by edentulous patients in order to provide better masticatory function. And also for psychological support that dentures will not change their position in oral cavity during eating or talking. Anatomical factors are a key component of denture stability and retention. But denture retention depends on complex relationships between adhesion, cohesion, atmospheric pressure, surface tension, and viscosity.

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Accordingly, DA and a thin layer of saliva between denture base and oral mucosa highly affect denture retention.^{1–3} Necessity retention of dentures is crucial especially for patients with xerostomia (eg, Sjögren syndrome). Dryness of the mouth can be related to systemic diseases, pharmacotherapy, and radiation therapy of head area structures. Additionally, patients with hormonal and neurotransmitter changes and disorders that affect muscle tension such as Parkinson disease, myasthenia gravis, muscular dystrophy, and buccolinguofacial dyskinesia may require DA.^{4–6}

Xerostomia vera is diagnosed on basis of clinical examination and standard sialometry tests. The most commonly used tests are the measurements of the amount of unstimulated saliva (u-SFR [unstimulated salivary flow rate]), stimulated saliva (s-SFR [stimulated salivary flow rate]), level of endocrine secretion of parotid glands (PAR-parotid secretion), and the palatal salivary glands (PAL-palatal secretion). The normal value of u-SFR and s-SFR are 0.3 to 0.6 mL/minute and 1 to 2 mL/minute, respectively. The values of the u-SFR <0.1 mL/minute and s-SFR <0.2 to 0.5 mL/minute indicate reduction in function of salivary glands.^{5–7}

DA improve quality of life of edentulous patients with xerostomia. These patients are more demanding than healthy ones due to sensitivity of oral mucosa. Using DA is not the solution—the treatment of causes and symptoms of xerostomia are also necessary. The aim of the study was to analyze patients with xerostomia on DA and to compare the opinions on different DA.

MATERIALS AND METHODS

The study was conducted with the approval of Bioethical Committee of Wrocław Medical University. The study subjects consisted of patients treated in Department of Prosthetic Dentistry, Wrocław Medical University, who consented to participate in the research project.

The study group contained 60 patients, 48 women and 12 men. The mean age of participants ranged from 63 to 77 years old (indicate range also). Each patient had a complete maxillary denture and partial or complete mandibular denture and prostheses were fabricated for all the participants. Reduced retention and stability of maxillary dentures was present in all cases. Perception of dry mouth was measured by a questionnaire. Xerostomia status was evaluated clinically using the standard sialometry tests (u-SFR). After 3-week period, the retention of maxillary dentures was scored by modified Kapur index before application of DA on denture acrylic base.^{8,9} The patients were divided into 4 groups based on the quality of denture resistance on vertical pull and lateral forces: A—very good retention, B—moderate retention, C—slight retention, and D—very slight retention. Then patients were randomly divided into 6 groups, 10 persons each. Each group was advised to apply different DA during 6-month observation period (Table 1). In order to reduce any possible bias of the brands of adhesives, all DA used by patients in the study were provided in nonlabeled bottles—only

TABLE 1. Random Division of Patients into Groups Depending on the Type of Dental Adhesives

Type of Adhesive	Name of Adhesive	Total Number of Patients
Adhesive seal	Secure	10
	Protefix	10
Adhesive powder	Protefix	10
Adhesive glue	Fitty-dent	10
	Blend-s-dent Extra Stark	10
Adhesive cream	Corega Fix&Fest	10

with assigned numbers. Protocols and precautions of adhesives were given to patients in order to reduce any possible side effects.

All the subjects were given detailed instructions on the use and application of the adhesive following manufacturers' recommendations including the amount and placement. The recommended time of using the adhesive was 12 hours during the day. Participants were required to remove dentures during the night and were advised to clean dentures according to their own hygienic habits.

In the study the following DA were used (with assigned numbers):

1. Adhesive seals: Secure firm by Jonson&Jonson (prepare on an agar base). Number of series: 4L027. Weight of 1 seal: 250 mg
2. Protefix: adhesive seals firm by Queisser Pharma (contents: viscose-cellulose 71 g and alginate sodium 29 g). Number of series: OA5269010. Weight of 1 seal: 570 mg
3. Adhesive powder: Protefix firm by Queisser Pharma (contents: alginate sodium 99.976 g, menthol, sodium chlorophyll in cupric salts). Number of series: 029091. Weight of package: 30 g
4. Glue for dentures: Fitty-dent firm by Fittydent International GMBH (contents: sodium carboxymethylcellulose, polyvinyl acetate, alcohol denatured, petrolatum, hydroxypropyl cellulose). Number of series: 280605. Contents: 40 g
5. Glue Blend-a-dent: Extra Stark firm by Wick Pharma (contents: polymaleic acid methoxyethylen -2.7:1, calcium-zinc salt 302 mg, carmellose-natrium 192 mg). Number of series: 81311. Contents: 40 mL
6. Adhesive cream: Corega Fix&Fest firm by Block Drug Comp. Inc (contents: copolimerisat methyl vinyl ether maleic acid, sodium magnesium zinc salt, carboxymethylcellulose sodium salt). Number of series: 01164A. Contents: 40 mL

After 6-month period patients filled the HRQL (Health-Related Quality-of-Life) Questionnaire.

HRQL Questionnaire consists of 8 questions:

1. Are you satisfied with the retention of your upper denture while using denture adhesive? Possible answers: very satisfied, fairly satisfied, not quite satisfied, and dissatisfied.
2. How did denture adhesive affect your maxillary denture retention? Possible answers: much better, little better, no difference, and worse.
3. For how long did the denture adhesive have an effect on retention of your maxillary denture? Possible answers: ≥ 12 hours, 8 to 12 hours, 4 to 8 hours, and < 4 hours.

4. Did the use of denture adhesive have an effect on your ability to chew? Possible answers: much better, little better, no difference, and worse.
5. Did the use of denture adhesive have an effect when you were not chewing? Possible answers: much better, little better, no difference, and worse.
6. Was it difficult to clean your denture after the denture adhesive had been applied? Possible answers: easy, not difficult, difficult, and very difficult.
7. Was it difficult to clean your gums after the denture adhesive had been applied? Possible answers: easy, not difficult, difficult, and very difficult.
8. Did the use of denture adhesive have an effect on condition of your mouth and showed clinical symptoms or complaints? Possible answers: burning, irritation, fetor ex ore (halitosis), and other.

Statistical Analysis

Analysis of variability of measurements for bench depending on application of DA and materials was done using analysis of variance. Comparison of measurements for bench between groups (materials) was made to the Tukey test HSD (honestly significant difference—test post hoc).

RESULTS

The evaluation of new maxillary dentures without adhesive established after 3-week adaptation period by Kapur index revealed that 10 patients had very good, 19 moderate, 27 slight, and 4 very slight retention. In subjective patients' opinion 4 had very good, 14 moderate, 35 slight, and 7 very slight retention of upper denture (Figures 1 and 2).

The results of HRQL Questionnaire revealed that 36% of subjects were satisfied with the retention of maxillary denture with the use of adhesive, and 18% were very satisfied. Two patients reported that retention of maxillary denture with adhesive was not rewarding.

Almost two-thirds of participants (61.6%) noticed positive effect of adhesive on retention of maxillary denture. One participant reported no difference in denture retention with the use of adhesive. Regarding the duration of effectiveness of adhesive, 36.6% of participants reported improved retention of maxillary dentures for more than 12 hours. Thirty percent of patients reported effectiveness of up to 8 hours. Nearly all the participants (98.8%) indicated that the ability to chew was increased while using adhesive—they responded “much better” (56.6%) or “better” (43.3%) chewing function. Of

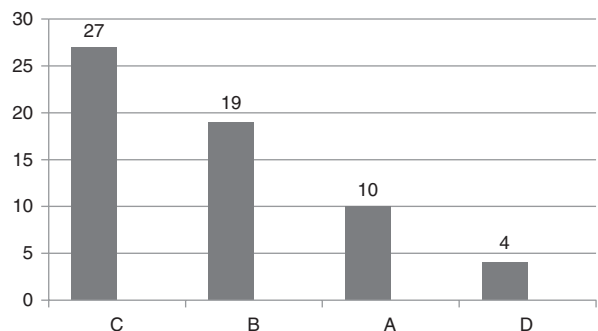


FIGURE 1. The retention of new maxillary dentures by Kapur index [very good resistance (A), moderate resistance (B), slight retention (C), very slight (D)].

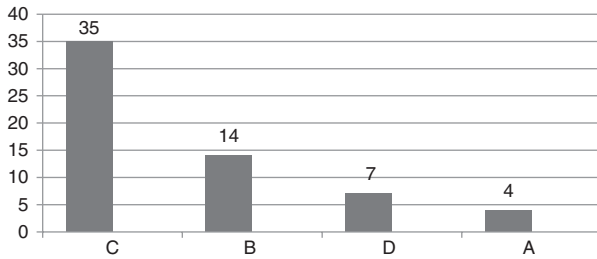


FIGURE 2. The retention of new maxillary dentures in subjective patients' opinion by Kapur index [very good resistance (A), moderate resistance (B), slight retention (C), very slight (D)].

the 60 patients who completed the questionnaire, none of them reported "worse" or "no difference" effect of adhesive on denture retention on masticatory function. In response to Question 5, most of those surveyed indicated that retention of maxillary denture, while not chewing, after applying adhesive is "much better" (83.3%) or "better" (16.6%). According to hygiene of dentures after using adhesives, 63.3% subjects said it was "difficult" and 20% that it is "very difficult" to clean the adhesive.

Forty-five percent of patients evaluated maintaining hygiene of mucosa after using adhesive as "easy." On the contrary, 21.6% of participants said that cleaning the oral

mucosa after applying adhesive on denture base was "difficult." The last question in survey was related to effects of adhesives on oral mucosa and clinical symptoms or complains. The majority of patients reported burning, compression and redness of the mucosa, and fetor ex ore (halitosis). Other responses to this question included ulceration, swelling, pain, difficulty in swallowing, aspiration to the respiratory tract, bleeding, vomiting reaction, metabolic disorders, and systemic complications.

Starting from the second month of applying DA in the form of adhesive seals, the appearance of fetor ex ore (halitosis) was observed. Moreover, the vomit reaction was often reported by patients. Similar side effects of DA were present after using powder adhesives. Symptoms related to adhesive seals, for example, Protefix may result of their chemical structure. The content of viscose-cellulose fibers is higher than in other types of adhesives. In addition, such fibers are thick and porous which can be the cause of irritation of oral mucosa and aggregation of denture plaque, which may lead to fetor ex ore (halitosis) and stomatitis. In the groups using adhesive glue and adhesive cream, the main complaints were itching and fetor ex ore (halitosis). The data are shown in Tables 2 and 3.

The result of statistical analysis Comparison of ratings survey among groups (materials) Tukeya HSD test was performed (post hoc test). Results (values of probabilities *P*) are provided in Table 4.

TABLE 2. Responses to Questions on the HRQT Questionnaire

Question No.	Response	No. of Respondents					Persons / %
		Secure	Protefix Seals	Protefix Powder	Fitty-Dent	Blend-a-dent	
1	1 Very satisfied	0	3	0	5	5	18 / 30
	2 Fairly satisfied	5	5	2	3	2	22 / 36
	3 Not quite satisfied	4	2	7	2	3	18 / 30
	4 Dissatisfied	1	0	1	0	0	2 / 3.3
2	1 Much better	4	8	3	7	8	37 / 61.6
	2 Little better	6	2	6	3	2	22 / 3.6
	3 No difference	0	0	1	0	0	1 / 1.6
	4 Worse	0	0	0	0	0	0 / 0
3	1 ≥12 h	0	3	0	5	7	22 / 36
	2 8–12 h	2	3	4	3	2	17 / 28.3
	3 4–8 h	6	4	5	2	1	18 / 30
	4 <4 h	2	0	1	0	0	3 / 5
4	1 Much better	3	6	1	8	7	34 / 56.6
	2 Little better	7	4	9	2	3	26 / 43.3
	3 No difference	0	0	0	0	0	0 / 0
	4 Worse	0	0	0	0	0	0 / 0
5	1 Much better	7	9	5	9	10	50 / 83.3
	2 Little better	3	1	5	1	0	10 / 16.6
	3 No difference	0	0	0	0	0	0 / 0
	4 Worse	0	0	0	0	0	0 / 0
6	1 Easy	9	0	7	0	0	16 / 26.6
	2 Not difficult	1	2	3	0	0	6 / 10
	3 Difficult	0	6	0	5	7	26 / 43.3
	4 Very difficult	0	2	0	5	3	12 / 20
7	1 Easy	10	6	8	2	1	27 / 45
	2 Not difficult	0	2	2	5	3	20 / 33.3
	3 Difficult	0	2	0	3	6	13 / 21.6
	4 Very difficult	0	0	0	0	0	0 / 0

TABLE 3. Subjective Evaluation of Patients' Health Complaints, Depending on the Type of Adhesion and Utilized Measure of Time of Treatment

Type of Preparation Complains	Observation Period in the Months and Assessment of Subjective Feelings of Patients																							
	1m		2 mo		3 mo		4 mo		5 mo		6 mo													
	P	M	F	I	P	M	F	I	P	M	F	I												
Secure	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	2	0	0	0	2	0
Protefix seals	0	0	0	0	0	0	2	1	0	0	3	2	0	0	2	2	0	0	2	2	0	0	2	2
Protefix-proszek	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3
Protefix powder	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3
Fitty-dent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blend-a-dent	0	1	1	0	0	0	1	0	1	0	1	0	0	1	2	0	0	1	1	0	0	1	1	0
Corega Fix&Fest	0	0	0	0	0	2	1	0					0	2	1	0	0	2	1	0	0	2	1	0
Coreg Fix&Fest	0	0	0	0	0	2	1	0	0	2	1	0	0	2	1	0	0	2	1	0	0	2	1	0

F = fetor ex ore (halitosis), I = other, M = tingling, P = burning.

For statistical analysis, the answers to the questions of the modified questionnaire—"HRQL questionnaire"—were scored on a scale of 5 to 2. In this analysis, the statistical results of clinical trials have been demonstrated in the study patients with chronic xerostomia, consuming evaluated preparations differences are statistically significant ($P < 0.05$).

DISCUSSION

The present study concentrates on the effect of adhesives on retention of maxillary complete dentures reported subjectively by patients. According to Berg, 66% of patients are not satisfied with their dentures. Sixty to seventy percent has a problem with retention and fitting of dentures.² This finding is in agreement with Kapur.^{8,9} The present study is consistent with those of Kelsey who indicated a substantial improvement in chewing effectiveness after using DA; however, Kelsey's study did not include patients with xerostomia.¹⁰ Although dryness of the mount affects relatively large of prosthodontics patient, there is

paucity of data on the impact of DA on the xerostomia patients. The symptoms of dry mouth and problems with adaptation of the prosthodontics appliance are evident especially among geriatric patients. Age, systemic diseases, diet, pharmacotherapy, and environmental conditions are the factors predisposing for xerostomia in this group of patients.^{7,11-13} Improved retention and stability of dentures lead to better chewing efficiency, distribution of loading forces on the oral mucosa and have beneficial effect on the respiratory track.¹⁴⁻¹⁶

The composition of DA is complex. There are components of plants and animals and synthetic compounds. The DA despite the local effect on oral mucosa may also have influence on the whole human organism. Therefore, nowadays just new generations of adhesives are used, those without sensitization or cytotoxic effect on human body (eg, aldehyde derivatives). Unfortunately, there are still observations showing discomfort of oral mucosa caused by adhesives.^{17,18} The present study evaluating participants' subjective opinions about adhesives included effect on the retention of maxillary denture, duration

TABLE 4. Comparison Survey Ratings Between the Analyzed Groups (Materials)*

Group Compared	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7
1: 2	0035	0078	0007	0125	0199	0000	0028
1: 3	0359	0373	0352	0303	0199	0370	0454
1: 4	0008	0184	0000	0012	0199	0000	0000
1: 5	0017	0078	0000	0042	0057	0000	0000
1: 6	0001	0184	0000	0003	0057	0000	0000
2: 3	0003	0009	0066	0012	0012	0000	0137
2: 4	0540	0655	0216	0303	1000	0028	0065
2: 5	0759	1000	0033	0605	0519	0180	0001
2: 6	0223	0655	0015	0125	0519	0370	0028
3: 4	0001	0029	0003	0001	0012	0000	0001
3: 5	0001	0009	0000	0003	0002	0000	0000
3: 6	0000	0029	0000	0000	0002	0000	0000
4: 5	0759	0655	0352	0605	0519	0370	0137
4: 6	0540	1000	0216	0605	0519	0180	0708
5: 6	0359	0655	0756	0303	1000	0653	0263

1 = Secure, 2 = Protefix, 3 = Protefix powder, 4 = Fitty-dent, 5 = Blend-a-dent, 6 = Corega.
* Probability values. The color red indicates statistically significant differences ($P < 0.05$).

of effect of DA, and the presence of mucosal symptoms under the adhesive-covered denture base. In addition, protect dry mouth syndrome was present. The causes of xerostomia were varied, but in general there was association with medications, age, gender, and history of current illness.

In complete dentures users group, the moisturizing effect of saliva is necessary to provide retention of prostheses. It has been reported that patients with xerostomia have more sore spots than patients with normal salivary flow.^{5,6} In contrast, other studies have shown that low salivary flow rates were not closely related to reduced masticatory function or retention and stability of dentures.¹⁹ Niedermeier and Kramer have found wear correlation between the secretion of palatal salivary glands and retention of upper complete dentures. However, the pharmacological induction of salivation improved retention of maxillary dentures.²⁰ The study carried out by Kapur revealed that in cases of patients with xerostomia the stability and retention of complete maxillary denture are weaker than in patients with the right salivation. It is necessary to indicate that these findings are based on subjective assessment of the patient and dentist.

None of the respondents in this study have had ever used any DA. On the basis of this study, it can be said that the choice of type of DA should be discussed by the patient and dentist according to possible side effects. For example, vomiting reaction and fetor ex ore reported by patients using adhesives might be caused not only by the chemical structure of the ingredients, but also by relatively thicker layer of adhesive. Viscose-cellulose fibers have a greater thickness and porosity than other compositions of adhesives, which may cause mechanical irritation of oral mucosa. Additionally, the construction of fibers observed in microscope promotes aggregation of debris and bacteria, which in case of poor oral hygiene may lead to fetor ex ore (halitosis) and stomatitis. As an effect of swelling of oral mucosa under the denture base malocclusion may appear. In contrast to other adhesives those based on viscose-cellulose fibers do not compensate uneven load on the mucosa by the masticatory forces. Thus, those types of adhesives are recommended for patients wearing old prosthesis or patients with severe bone loss.

The choice between cream and powder is very subjective. Adhesive powder works faster, but the effect is smaller and shorter than after using adhesive cream. It can be used in smaller amount than cream and it is easier to clean the denture after using the powder than cream. The cream is commonly recommended as it has low tendency to be leached by the liquid in the mouth, providing strong and long-term effect.

The amount of adhesive applied depends on the space between denture base and mucous membrane and size of prosthetic foundation. The principle “the more, the better” is not suitable for these dental materials. The optimum effects of cream and powder are provided by the small amount of them—suggested layer is 1 mm thick. Adhesive powder should be spread evenly on clean and moist prosthesis. Cream should be applied on the dry prosthesis in small amounts around the incisor and molar areas. Also application along posterior border and palatal shaft is recommended. Cream can also be distributed in small “dots” every fifth millimeter. Patients with xerostomia should moisten the prosthesis with applied adhesive; otherwise dry mucous membrane would initiate the drying effect of DA. Regardless of the type of adhesive the denture should be lead to oral cavity and held tightly for a while. The amount of adhesive pushed out from under the edge of the prosthesis should be minimal.

The patient must be informed that the daily removal of DA from prosthesis base oral mucosa is an essential requirement. It is proved that night break in wearing dentures enables regeneration of the mucosa, which is important especially in cases of patients with dry mouth whose oral mucosa is sensitive and susceptible to development of stomatitis. During night break contact with the potentially allergenic compounds of adhesives is also avoided.

The study showed that adhesives evidently improve the maintenance of dentures on prosthetic foundation and might be a solution when there are problems with achieving proper retention and stabilization of complete dentures. It is important to emphasize that adhesives should not be used to veil clinical and laboratory inaccuracies that occur in process of dentures fabrication.

Patients often use large quantities of adhesive in order to provide retention of old prosthetic appliances. There is no conclusive evidence to support thesis that using adhesives in such conditions is neutral for the osseous structures under denture base. Because the preparations are liquid or semiliquid, they are unable to cause bone resorption. Instead they favor increased tolerance and adaptation of osseous structures to ill-fitting dentures.

Contraindication for adhesives usage is damaged or broken prostheses. Applying DA demands proper hygiene of the prosthesis and oral cavity. Regular checkups are necessary in order to check if the dentures are in the good mechanical and hygienic condition and to educate patients.

CONCLUSION

DA provide noticeable improvement in retention and stabilization of maxillary complete dentures by providing better masticatory function and psychological comfort to patients. These materials are difficult to clean from the denture base, which may be an important consideration for patients with xerostomia and additional instructions and follow-up recall appointments may become necessary. Despite some inconvenience and the possibility of side reactions, all patients participating in the study positively evaluated the DA and intend to apply it regularly under medical supervision. They also declared their participation in further studies (eg, dynamometrical test).

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