

Original Research

A comparative study to evaluate the effect of three denture adhesives on the retention of mandibular complete dentures for diabetic patients

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ABSTRACT:

Aim: A comparative study to evaluate the effect of three denture adhesives on the retention of mandibular complete dentures for diabetic patients. **Methods:** This prospective observational study was carried out in the Department of Prosthodontics, Crown & Bridge and Implantology of the institute. 30 male completely edentulous patients, with their ages ranged from 49 to 69 years, were included in this study. The universal testing machine was used to measure forces required to dislodge the dentures. Retention of mandibular complete dentures was measured without adhesive and with the use of three types of denture adhesives after adaptation period of 1 month. **Result:** The Fittydent adhesive has higher dislodgement values when compared with the other adhesives after 2-h time intervals. Using paired Student's t test for the different values of dislodgement forces revealed that there is a highly significant difference, $P < 0.0001$, in the amount of retention for all types of adhesives compared to its values without adhesives during all time intervals. Student's paired t test was used to make a comparison between the dislodgement values of the three types of denture adhesives (Fittydent, Protefix, and Corega) at different time intervals. The results showed that there is a highly significant difference, $P < 0.0001$, when comparing between Fitty- dent and Protefix denture adhesives and also between the Fittydent and Corega denture adhesives while there is a non-significant difference, $P > 0.05$, between the Protefix and Corega denture adhesives at the baseline and 1-h and 2-h time intervals. **Conclusion:** We concluded that denture adhesives increase retention of complete dentures. The Fittydent adhesive paste was more effective in improving the retention than the Protefix and Corega adhesive creams. Therefore, denture adhesives improve patient satisfaction.

Keywords: denture adhesives, mandibular, diabetic patients

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INTRODUCTION

The goal of prosthetic dentistry has always been the improvement of retention and stability, major properties that determine the performance of a removable prosthesis. Complete denture wearers are often challenged with varying proportions of looseness of their prosthesis and complain of displeasure and/or reduced masticatory function or speech. Edentulous patients treated with complete dentures report of both functional disturbances and psychological problems.^{1,2} According to Zarb et al.,

the term "denture adhesive" refers to a commercially available, nontoxic, soluble material that is applied to the tissue surface of the denture to enhance retention, stability, and function.³ The constituents of most denture adhesives are almost consistent. Stafford et al. have identified the major constituents of adhesives. The ingredients fall into three main groups.^{4,5} The first group consists of those that swell, gel, or dissolve in water and display greater and varying degree of viscosity, (e.g., karaya gum, tragacanth gum, pectin, gelatin, methyl cellulose, hydroxymethyl cellulose,

sodium carboxy methyl cellulose, synthetic polymers, such as polyethylene oxide, acrylamide, acetic polyvinyl). The second group consists of those materials that act as antiseptic, antibacterial, and antimycotic agents such as hexachlorophene, sodium tetraborate, sodium borate, and ethanol and the third group consists of those additional materials that serve as fillers, preservatives, plasticizers, flavoring, and wetting agents. Early adhesives were made from vegetable gums such as acacia, tragacanth, or karia that adsorb water to form a mucilaginous layer between the denture-bearing tissue and the denture base, but they were highly soluble in the mouth making the denture adhesive useful for only a relatively short period.⁶ Manufacturers are continuously changing the composition of denture adhesives to improve the efficacy of their products. Currently, denture adhesives can be divided into soluble and insoluble groups. The insoluble group comprises of pads and synthetic wafers, whereas the soluble group includes creams, pastes, and powders.⁶ Pads and wafers are very different from creams and powders. The unique feature of pads and synthetic wafers is the inclusion of a fabric carrier impregnated with an adhesive. In a study of Koksai et al., which showed that (56.3%) of all dentists used denture adhesives in clinical steps, whereas (41.8%) dentists recommended to their patients when indicated.⁷ Indications of denture adhesives include trial bases, immediate dentures/transitional dentures, reconstruction or pre-prosthetic surgery, psychological support, compromised anatomic structures, physically/mentally challenged patients, xerostomia, and osseointegrated implants.⁶ Contraindications of denture adhesives include patients with open cuts or sores in the mouth, an ill-fitting denture, patients allergic to denture adhesives, and patients with broken dentures, missing flanges, or sectional fractures. Although denture adhesives have been widely accepted by patients, prosthodontists and dental professionals have been hesitant to advocate these over-the-counter products. To date, the topics of their effectiveness, recommended use, and biocompatibility remain a matter of debate in the dental community.⁸⁻¹⁰

MATERIAL AND METHODS

This prospective observational study was carried out in the Department of Prosthodontics, Crown & Bridge and Implantology of the institute, after taking the approval of the protocol review committee and institutional ethics committee. 30 male completely edentulous patients, with their ages ranged from 49 to 69 years, were included in this study.

INCLUSION CRITERIA

- Patients were controlled diabetic type 2 without former dentures.
- They have low well-rounded mandibular ridges covered with firm healthy mucosa without any

signs of inflammation or flabby tissues, normal jaw relationships, normal tongue size, and normal temporomandibular joint function.

EXCLUSION CRITERIA

Smokers and patients suffering from xerostomia were excluded. An informed consent form was signed by all patients before treatment. A heat-cured acrylic resin complete denture was constructed for each patient in a conventional manner. Patients were informed to use their new dentures for 1 month as an adaptation period.

INSTRUCTIONS FOR ALL PATIENTS

The fitting surface of the denture must be clean and dry before application of the adhesive. The patients were instructed to use the Fittydent cleansing tablets that were given to them, before each application. The adhesive should be kept at room temperature, and it is preferred to warm the tube in the hands for a short time before application. The patients were instructed to apply little amount of the adhesive on a previously prespecified spots on the fitting surface and away from the edge of the denture and patients must be asked to close firmly in centric occlusion & hold in place for few seconds to wait for 15 minutes before starting the adhesive testing. The applied amount varies from 0.15 to 1 g depending on the physical preparation of the adhesive and on the size of the individual denture. The tube must be tightly and immediately closed after each application and the nozzle of the tube must be clean. Retention was measured using a universal testing machine. The retention was measured according to Van Kampen et al,¹¹ and Ashour et al,¹² Duqum et al.¹³, Salman,¹⁴

METHODOLOGY

Two small metal tubes (3-mm diameters) were placed a few millimeters underneath the premolars in the mandibular denture. The dentures were rigidly and reproducibly connected to two pins in the horizontal metallic arm and turned to the universal testing machine. After a 1-month adaptation period, the patient was instructed to sit down in an upright position and his chin firmly seated on a chin support on the testing machine. The bar was rigidly connected to the denture. Vertical dislodging force (expressed in Newton) applied by the universal testing machine increased gradually until dislodgement of the denture occurred. The test was repeated three times and the average of these records was taken every time during the follow-up period. Retention of mandibular complete dentures was assessed after a 1-month adaptation period without the use of adhesive; this served as the control. The first adhesive was applied, and average records after 15 min, 1 h, and 2 h were recorded. Then, the denture was cleaned and kept in water for the second day. The second adhesive was applied on the second day, and average records were recorded after 15 min, 1 h, and 2 h. The third adhesive

was applied on the third day, and average records were re- corded after 15 min, 1 h, and 2 h. After finishing the measurements, the metallic tubes were removed and the denture was polished and returned to the patient.

STATISTICAL ANALYSIS

Statistical analysis was performed with SPSS 25.0. Data were presented as mean and standard deviation. P value less than 0.05 was considered as the level at which statistical significance exists.

RESULTS

The mean and standard deviation of measurements of dislodgement forces of a poorly fitted mandibular complete denture without a denture adhesive and at various time intervals with the use of the denture adhesives (Table 1) Al- Abdulla & Khamas¹⁵ revealed that the mean of dislodgement forces was increased with the use of the denture adhesives and the denture adhesives showed an increase in the denture retention with increase of the time of the experiment.

Table 1 Mean dislodgement forces in grams of poorly fitting mandibular complete dentures without adhesive and at various time intervals with the use of denture adhesives

		Mean	SD	C.V%
Without adhesive		483.2	54.87	11.35
Fittydent adhesive paste	Baseline	1024.3	81.19	7.92
	1 h	1119.4	85.70	7.65
	2 h	1208	76.54	6.34
Protefix adhesive cream	Baseline	825.10	58.84	7.12
	1 h	931.7	48.27	5.18
	2 h	973.2	48.36	4.97
Corega adhesive cream	Baseline	810.6	54.19	6.68
	1 h	911.4	47.61	5.22
	2 h	967.4	73.88	7.63

Table 2 Comparison of dislodgement forces of poorly fitting mandibular complete dentures without adhesive and with the use of three types of denture adhesives at various time intervals (Student's paired t test)

	t test	P value	t test	P value	t test	P value
Immediate	17.47	0.000	13.48	0.000	13.43	0.000
1 h	19.78	0.000	19.42	0.000	18.65	0.000
2 h	24.32	0.000	21.19	0.000	16.65	0.000

Table 3 Comparison of effectiveness among the denture adhesives at each time intervals (Student's paired t test)

	Immediately		1 h		2 h	
	t test	P value	t test	P value	t test	P value
Fittydent and Protefix	6.26	0.000	6.03	0.001	8.18	0.000
Fittydent and Corega	6.93	0.000	6.71	0.001	7.14	0.000
Protefix and Corega	0.62	0.56	0.96	0.37	0.22	0.85

The Fittydent adhesive has higher dislodgement values when compared with the other adhesives after 2-h time intervals. Using paired Student's t test for the different values of dislodgement forces revealed that there is a highly significant difference, $P < 0.0001$, in the amount of retention for all types of adhesives compared to its values without adhesives during all time intervals (Table 2). Student's paired t test was used to make a comparison between the dislodgement values of the three types of denture adhesives (Fittydent, Protefix, and Corega) at different time intervals (Table 3). The results showed that there is a highly significant difference, $P < 0.0001$, when comparing between Fittydent and Protefix denture adhesives and also between the Fittydent and Corega denture adhesives while there is a non-significant difference, $P > 0.05$, between the Protefix

and Corega denture adhesives at the baseline and 1-h and 2-h time intervals.

DISCUSSION

Psychological benefit is provided by retention and if a denture can easily be dislodged during speech or mastication, the embarrassment experienced can be mentally traumatic. Retention is affected by various factors such as adhesion, cohesion, interfacial surface tension, mechanical locking into undercuts, peripheral seal, atmospheric pressure, and orofacial musculature. Denture adhesives are used to improve the retention and stability of complete dentures.¹³ In the present study, denture adhesives significantly increase denture retention at all time intervals ($P < 0.0001$), and this is in agreement with Salman.¹⁴ The main components of denture adhesives are either

vegetable gum or synthetic polymer as carboxymethyl cellulose and polyvinyl methyl ether maleate. As the adhesive absorbs water and the carboxymethyl cellulose comes in contact with the saliva, the hydrate material (free carboxyl groups) is formed and swells greater than their original volume, thereby excluding air between denture bases and bearing tissue. The hydrate material sticks to the fitting surface of the denture and oral mucosa and increases the viscosity of the saliva. These actions increase the retention of complete dentures. Free carboxyl groups formed by the wetting of adhesives such as methyl cellulose or hydroxyl methyl cellulose, form electrovalent bonds that produce stickiness or strong bioadhesive forces.¹⁶

The three types used of denture adhesives used instantly started increasing retention; their effectiveness increased progressively from the baseline, and maximum retention was attained after 2 h. Saliva could not flow definitely into the space between the denture base and mucosa. Also with the increase of time, the salivary flow decreases.^{17,18}

Fittydent recorded higher dislodging values which were of highly significant difference ($P < 0.0001$) when compared with Protefix and Corega throughout all time intervals, while both Protefix and Corega showed no significant difference ($P > 0.05$) when compared with each other throughout all time intervals.¹⁹ The insoluble Fittydent adhesive paste had higher values of displacing forces when compared with Protefix and Corega adhesive creams which make it not affected by saliva and liquids. The insoluble Fittydent provides strong bioadhesive and cohesive forces between the polyvinyl group and the carboxymethyl cellulose. The carboxymethyl cellulose provides a quick hold and the polyvinyl group holds it for a long interval, and thus it increases the retention of mandibular complete dentures.²⁰ The hydrate material formed by carboxymethyl cellulose stay intact because of the insoluble properties of the Fittydent denture adhesive paste, this action delays the washing away of the polymer by the salivary flow so that the effective life of the polymer during use is increased, thereby markedly increasing the retention of mandibular complete dentures.²¹ Denture adhesives improved the retention of the dentures more so for poorly fitting dentures than well-fitting dentures.²²

CONCLUSION

We concluded that denture adhesives increase retention of complete dentures. The Fittydent adhesive paste was more effective in improving the retention than the Protefix and Corega adhesive creams. Therefore, denture adhesives improve patient satisfaction.

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