

Effect of denture adhesives on the retention of maxillary complete denture

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ABSTRACT

Background: Using of denture adhesives improved the retention and stability of complete denture, so it is important for the success of complete denture treatment when it is used according to its indications.

Materials and methods: This project was carried out in an attempt to measure and compare the effectiveness of denture adhesives (Boots, Super corega, and Lacalut denture adhesive) in a well fitting maxillary complete denture at various time intervals. The retention of well fitting maxillary complete denture with saliva alone and with the use of denture adhesives at different time intervals was measured as a resistance to dislodgment using loading apparatus.

Results: The study revealed that there is a highly significant improvement in the retention of a well fitting maxillary complete denture after using any one of the three types of the denture adhesive. Statistically the three type of denture adhesives used in this study have approximately the same effectiveness with slightly difference in the time of action.

Conclusion: The use of any type of these denture adhesives that were accepted by patient (whether vegetable gum or synthetic polymer, powder or paste) can improve the retention of the complete denture.

Keywords: Denture adhesive, retention and complete denture. (*J Coll Dentistry* 2005; 17(1): 30-35)

INTRODUCTION

Sufficient retention constitutes a basic and important requirement for the acceptance of complete dentures by the patient¹. The influence of adhesive and cohesive forces, surface tension, atmospheric pressure, viscosity and volume of saliva, gravity, muscle posturing and occlusion on denture retention has been documented². These factors have a significant influence on conventional complete denture treatment. Occasionally it is not possible to achieve optimal denture retention and stability because of other factors not influenced by adequate denture fabrication alone. These factors include poor jaw and ridge relationships, psychological conditions, neuromuscular coordination, and inadequate vestibular depth. Improving retention and stability of denture is of a considerable interest in prosthetic dentistry. Approaches to the problem over the years have included over dentures, implants, and denture adhesives³.

Denture adhesive improve the confidence level of new denture wearers enabling them to adjust to eating and socializing in public⁴. Improvement have been also reported in chewing efficiency and bite force with a greater distribution of occlusal forces over the denture bearing tissues reducing local pressure point. Adhesives provide a cushioning or lubricating effect, which reduces friction and mucosal irritation⁵.

Grasso et al. used quantitative methods to measure the effects of denture adhesive on the retention and stability of the maxillary denture. They found that the denture adhesive produced a statistically significant improvement in the retention and stability of maxillary denture during the various activities for up to 8 hours. There were no statistically significant differences in improvement between a poorly fitting and well fitting denture⁵.

Ghani et al. evaluated objectively and clinically the relative improvement in retention forces of complete denture with the use of three proprietary denture adhesives. Using the UCL retentiometer they found that the force with saliva alone were consistently and significantly lower when compared with the forces measured at any test period with use of the test adhesives. A six fold improvement in forces from the salivary baseline values was observed when denture adhesives were used⁶.

The purpose of this study was to measure and compare the effectiveness of denture adhesives (Boots, Super corega, and Lacalut denture adhesive) in a well fitting maxillary complete denture at various time intervals.

MATERIALS AND METHODS

Twenty edentulous patients were selected from prosthodontic clinic, the college of dentistry, Baghdad University. The sample consisted of 12 males and 8 females, the age range between (40-78) years. Patients were selected according to the following criteria:

(1) Assistant lecturer, Department of Prosthodontic, College of Dentistry, University of Baghdad.

(2) Professor, Department of Prosthodontic, College of Dentistry, University of Baghdad.

1. Patient has new maxillary complete denture, (1-4) week after first placement of dentures.
2. Patient has no or slightly unilateral, bilateral, distal or anterior under cuts on the maxillary arch.
3. Patient has satisfactory denture bearing tissue according to Kapur's criteria ^{3,7}, without any inflammatory or denture sore areas.
4. Patient has clinically satisfactory maxillary complete denture (well fitted) according to Kapur's criteria, which adapted for maxillary denture assessment ⁷.
5. The patient was willing to participate and cooperate through out the entire study.

Measurement of the Retention

For purpose of this study retention has been expressed in terms of the force required to dislodge vertically a maxillary complete denture using loading apparatus. This apparatus consists of three parts, Fig. (1). Metal bar (Part A) have round surface radius (3 mm) fixed to the palatal surface of maxillary denture base just below the plane of occlusion in the region relating to first and second molars teeth, using cold cure acrylic resin, Fig.(1A). Metal bar was served as a means of connecting to the attachment part. Attachment part (Part B) was used for all subjects, Fig. (1B). This part is square in shape of (5 mm), consists of three grooves (No. 1 &2) (2 mm) deep for holding part A, groove No.3 for upper central incisors (lever center). Lever arm ratio is equal. Part (C) of loading apparatus consists of an adjustable stand and pulley (diameter 10 inch) shown in Fig.1C. Over which a metal wire covered by rubber, a metal hook was attached to one end of wire to hold plastic container and the other end is attached to attachment part by screw.

One day before the first measurement, denture was taken from the patient and a metal bar was fixed by cold-cure acrylic resin to the palatal surface then the denture was kept in water. So the patient did not use the denture before and during the three measurement days. The three denture adhesives used in this study were Super corega powder (Stafford-Miller Ltd. Hatfield Herts, England) main components are carboxyethylcellulose, α hydroxy- γ -hydroxy-poly[oxyethyleness].

Boots denture adhesive powder (Boots Company PLC. Nottigham, England) main component is Karaya gum. Lacalut Dent. Gel (paste) (Arcam GmbH Germany) main

components are mixed sodium/calcium salt of poly[vinyl methyl ether / maleic Anhydride], cellulose Gum and petrolatum.

In testing operation, the patient's head was held firmly against the head rest support. Upper and lower dentures were inserted in patient's mouth and patient closed the jaw in centric occlusion for 5 second. The attachment part was connected to metal bar and the loads were applied in the plastic until the dislodgment of the maxillary complete denture happens, then the weights of the loads were calculated. The same procedure was followed for all remaining patients.

At the first day of testing, retention of the maxillary denture was first recorded 15 minutes after insertion without the use of any denture adhesives. Measurements were repeated in the same manner, 15 minutes after the adhesive was applied (base line) and at 1 and 2 hours after first measurement with denture adhesive. After that the denture was removed carefully, cleaned and kept in water. All these measurements were repeated in the next day using a second type of adhesive and at the third day using the third type of adhesive. After finishing with the measurements, the metal bar was removed and the maxillary denture was polished and returned to the patient.

Adhesive amounts varied from (0.15-1) gm depending on physical formulation (powder or paste) and on the size of the individual denture. The powder adhesive was applied onto the whole of the moistened tissue surface of the complete denture in excess and the surplus dislodged by gentle tapping according to the manufacturer's recommendation. Paste denture adhesive was divided into 5 spots on the fitting surface of maxillary complete denture according to the manufacturer's recommendation.

RESULTS

The results indicated the means of measurements of retention force of well fitting maxillary complete denture with saliva alone and at various time intervals with the use of the denture adhesives. Table(1) revealed that; the mean of measurements of retention force will increase with the use of denture adhesives and the retention force for both types of powder adhesive shown a decrease in the amount of retention with increase of time, while the paste denture adhesive showed an increase in retention with increase of the time of the experiment.

The mean and standard deviation of the effectiveness of the denture adhesive at different time intervals showed that Super corega denture adhesive (powder) had greater effectiveness at baseline while Lacalut Dent paste had greater effectiveness at 2 hour time interval.

Using paired student's t-test for the different values of retention revealed that there was a highly significant difference at ($P < 0.01$) in the amount of retention for all types of adhesives in comparison with saliva. Whereas the one way analysis of variance of the retention forces at the three days of measurement revealed that there was no significant difference in the amount of the retention of maxillary complete denture with saliva alone ($F = 0.0058, P > 0.05$).

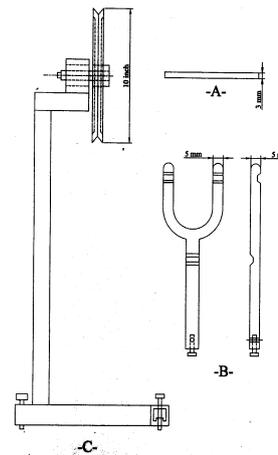


Fig. (1): Schematic drawing. (A) Steel Bar. (B) Denture Attachment Part. (C) Loading Apparatus.

Table (1): The mean retention forces in grams of well fitting maxillary complete denture with saliva alone and at various time intervals with the use of the denture adhesives.

Type of denture adhesive	Statistic	Retention force with saliva alone	Retention force with using of denture adhesives		
			Base line	One hour	Two hour
Boots denture adhesive powder	\bar{X}	848.5	1700.95	1628.85	1557.5
	SD	2272 ±	454.98 ±	433.1 ±	428.68 ±
	CV%	26.7	26.7	26.6	27.5
Super corega denture adhesive powder	\bar{X}	841.1	1708	1627.6	1567.2
	SD	224.68 ±	446.7 ±	432.7 ±	418.6 ±
	CV%	26.7	26.1	26.5	26.7
Lacalut dent paste denture adhesive	\bar{X}	846.6	1597.75	1636.65	1684.4
	SD	225.2 ±	406.9 ±	419.8 ±	447.4 ±
	CV%	26.6	25.4	25.6	26.5

Paired t-test between the effectiveness of each type of the denture adhesive at different time intervals were performed. The result showed no significant difference ($P > 0.05$) between the effectiveness of each type of the denture adhesive at different time points. The ANOVA test showed that there is no significant difference among the effectiveness of the denture adhesive at the baseline, after 1 and 2 hour time interval ($P > 0.05$).

Student paired t-test's were used to make comparison between powder denture adhesive (Boots and Super corega) and paste denture adhesive (Lacalut Dent), and between vegetable gum (Boots) and synthetic polymer denture adhesive (Super corega) at different time intervals. The result (Table 2) showed no statistically significant difference between powder and paste denture adhesive, and between vegetable gum and synthetic polymer denture

adhesive at different time intervals ($P > 0.05$). Analysis of variance was used to make comparison at time interval between the three denture adhesives. The result showed that the denture adhesives had a statistically similar effectiveness at each time interval.

DISCUSSION

Several studies have been conducted to evaluate the denture adhesive effectiveness, measured either subjectively or by determining the biting forces, or the forces required to dislodge a denture or palatal plate. In present study, the loading apparatus are used to dislodge a well fitting maxillary complete denture, because denture adhesives are indicated to be use for a well fitting properly fabricated complete denture and should not be used with ill fitting denture. With using a well fitting denture

the result become more precise in expression of the effectiveness of denture adhesive that is used according its indication by denture wearers.

Mechanical interference, such as undercuts usually present in clinical situation would contribute further resistance to dislodgment in addition to vertical retention forces. So the

dislodgment of well fitting denture in the presence of sever undercut required high force that might cause possible damage to the tissue or cause pain and discomfort to the patients. Since the retention forces were compared with and without the use of denture adhesives for the same subject it were not important to explore the effect of age and sex.

Table 2: Comparison of effectiveness among the denture adhesives at each time intervals (student's paired t-test)

Source of variation D.A. × D.A.		Time intervals	t-value	P-value	C.S
Effectiveness of Boots denture adhesive	Effectiveness of Super corega denture adhesive	Base line	-0.551937	P > 0.05	NS
		1 hour	-0.120693	P > 0.05	NS
		2 hour	-0.202188	P > 0.05	NS
Effectiveness of Boots denture adhesive	Effectiveness of Lacalut Dent paste denture sdhesive	Base line	1.255444	P > 0.05	NS
		1 hour	0.132198	P > 0.05	NS
		2 hour	1.284552	P > 0.05	NS
Effectiveness of Super corega denture adhesive	Effectiveness of Lacalut Dent paste denture adhesive	Base line	1.385020	P > 0.05	NS
		1 hour	0.210881	P > 0.05	NS
		2 hour	1.139235	P > 0.05	NS

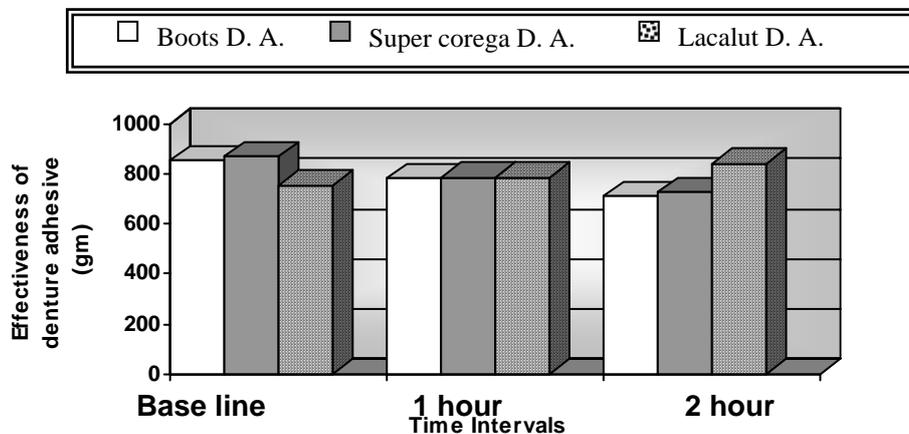


Figure 2: Effectiveness of denture adhesives according to different time intervals

The main components of denture adhesive are either vegetable gum as Karaya gum or synthetic polymers as carboxymethylcellulose (CMC). When Karaya gum or CMC come in contact with saliva, the hydrate material is formed and swells in presence of saliva / water and flows under pressure, thereby eliminating voids between denture base and bearing tissue. Hydrate material stick readily both the tissue surface of the denture and the mucosal surface

of the basal seat, and increases the viscosity of the saliva. These actions markedly increase the retention of the complete denture. Statistically the difference between the effectiveness of each type of the denture adhesive at the different time intervals are nonsignificant (P>0.05). These findings come in agreement with several authors^{4,8,10}. This is due to decrease of salivary flow in edentulous subjects with powder denture adhesive, maximum retention was

achieved rapidly but its effect decreased with time due to the washing off effect of the saliva. The paste denture adhesive behaved differently from powder. Paste denture adhesive which starts its action immediately and reach to accepted retention rapidly, its effectiveness increased gradually from base line and maximum retention was achieved at 2h-time interval. These findings come in agreement with several authors^{3,4,11}. The oily medium in which the active ingredients of the paste are incorporated, delaying the rapid activation of paste denture adhesive, ultimately prolongs its duration of action and maintains the higher level of force achieved⁹.

Boots denture adhesive (Karaya gum) showed to be less effective than that of Super corega (synthetic polymer) at all time intervals, but this difference is statistically not significant ($P > 0.05$). Statistically there is no significant difference between the denture adhesives at all time intervals ($P > 0.05$).

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