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Research Article

A COMPARATIVE ANALYSIS OF THE EFFECT OF THREE TYPES OF DENTURE ADHESIVES ON THE RETENTION OF MAXILLARY DENTURE BASES: AN IN VIVO STUDY

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ABSTRACT

The success of complete dentures depends on sufficient retention. Denture adhesive are regularly used by denture wearers to improve the function of complete denture. We evaluated the effect of three different denture adhesives on the retention of maxillary complete denture using digital dynamometer. The retention test for control group, powder group, strip group, paste group was done using a customised force sensor device. Readings were subjected to ANOVA followed by post hoc test. Results show that the retention force value of strip group was the maximum, followed by paste group, powder group and the least retention force value was observed with control group.

INTRODUCTION

Optimal outcome of complete denture treatment depends on the successful integration of the prosthesis with the patient's oral functions and psycological acceptance of the dentures by the patient. These parameters require that patients perceive their dentures as stationary or well retained during function and that the prosthesis and their effects on the face meet the esthetic and psyshodynamic requirements.[1]

Adequate retention is a basic requirement for the acceptance of complete dentures. According to Glossary of Prosthodontic Terms-8, Retention is defined as "that quality inherent in the dental prosthesis acting to resist the forces of dislodgement along the path of placement".[1,2]There are several factors involved in the retention of dentures. They are interfacial force, adhesion, cohesion, atmospheric pressure.[1,3]

There are occasional situations in which it is not possible to obtain the desirable optimal retention like improper denture base extensions, compromised denture supporting hard and soft tissues which include excessive ridge resorption, developmental abnormalities, etc. In these instances, different mechanical aids to retention like springs, suction chambers, suction rubber discs and magnet are used. Since, these mechanical aids cause some ill effects to the surrounding tissues, many patients frequently resort to the use of denture adhesive. Denture adhesives are used to increase the retention and stability of the complete denture which in turn will improve the chewing and masticatory ability and also provide psycological comfort to the paient.[4,5]

Denture adhesive is referred to a commercially available, non-toxic *soluble* material that is applied to the tissue surface of the denture to enhance retention, stability and performance.[6] The denture adhesives are thin wafers of water-soluble materials that are adherent to both basal tissue and denture base and these lack the ability of flow.

Currently, the denture adhesives available can be divided into soluble and insoluble group.The insoluble group includes pad and synthetic wafers; the soluble group includes creams, pastes, and powder. Many investigator stated that denture adhesives are effective following initial placement and these beneficial effect diminish over time as a result of the breakdown of the adhesive by oral fluids.There are many methods to measure retention in a complete denture like using hydrolic pulley, radio telemetry, cineradiography and gnathodynamometry, etc.[3]

The purpose of this study was to examine the effects of three types of denture adhesives on retention of maxillary complete denture using digital dynamometer.

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MATERIALS AND METHODS

The study was examined on 60 patients with completely edentulous maxillary arch with healthy mucosa, without any undercut, fair to poor ridge Xerostomia, poor neuromuscular patient, unco-operative patients, palatal defects, flabby ridge were excluding criteria for this study. This study was performing in prosthodontics department, Govt. Dental college and hospital, Ahmedabad after obtaining permission from the Institutional Ethics Committee. ethical committee no IEC GDCH/PR.6/2018

Fig 1 Materials used for testing retention of denture base and denture adhesives.

Primary impression with irreversible hydrocolloid impression materials and secondary impression with zinc oxide eugenol in custom fabricated tray is taken, master cast was fabricated. A sheet of baseplate wax was adapted to the master cast. Flasking was done according to morrow [7]. Long curing cycle was followed for acrylization of the denture base and overnight bench cooling was done before deflasking. The denture base was stored in water for 17d at room temperature before testing for retention.

Fig 2 Placement of the hook in centre of denture base

After deflasking, polishing and finishing the denture base, hook is attached in the centre of the denture base by using surveyor. Hook is sticked with cold cure acrylic over the denture base. (Figure 2)

We fabricated customized apparatus (Figure 3), in which one end was attached with the hook over the denture base via nylon thread (figure 5) and on other end digital

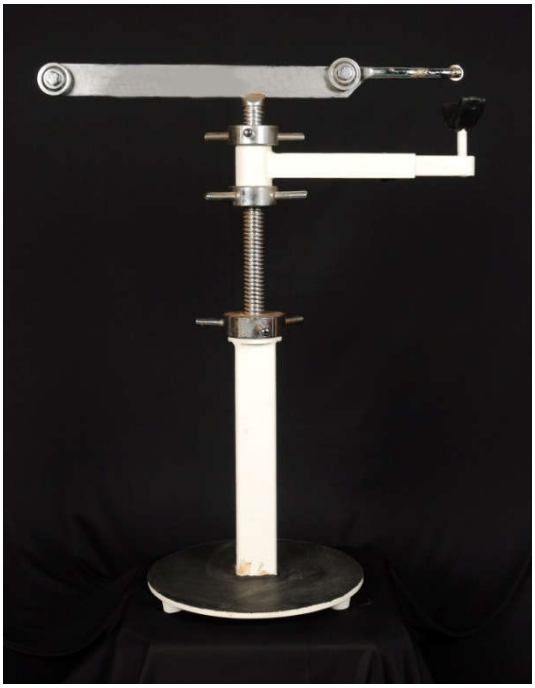


Fig 3 Customized apparatus for testing retention of denture base

Dynamometer was attached. Before testing the denture base for retension, the patients were trained to tell, when the denture base was going to be dislodged. The dislodging force were notified on digital dynamometer. Patient's head was stabilized on the head stabilizer of the OPG machine.(figure 4)

The denture base without any adhesive was the control group, group I was denture base with Fixon Powder, group II with Fixon supergrip paste, group III was polygrip denture adhesive strips. Powder form of denture adhesive was sprinkled over the impression surface of the denture base, for the paste form, the denture base was dried and bead size of Fixon supergrip paste was applied on the incisor, molar region and

Fig 4 patient head was stabilized with opg machine.

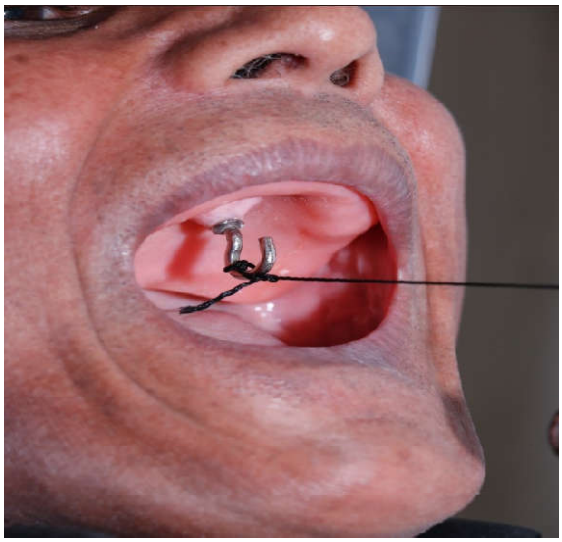


Fig 5 Intraoral position of denture base with hook; nylon thread was attached with hook.

strip form was applied according to manufacturer's instructions, cut it in a three piece and stick it in triangle form; two were placed in incisor to molar region, third was sticked on posterior region. All three test were performed on the same day. The tested group were placed in mouth for 3 minute, after which the dislodgement force was measured on the screen of DD. The result was recorded in grams on DD was tabulated. Retention with each denture base was tested three times. In order to avoid bias by the investigator, other post graduated student has to applied the same test in patients mouth.

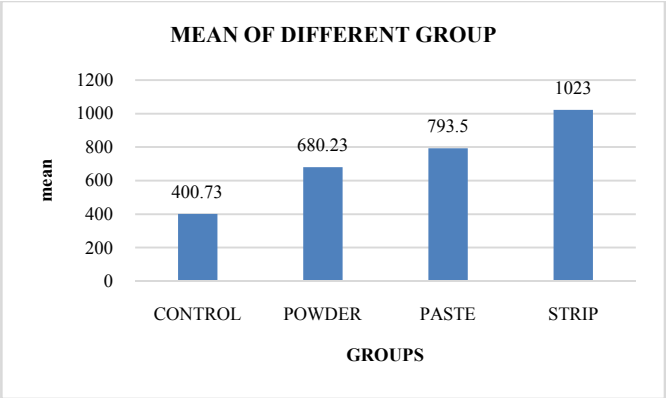
The retention values of all groups were tabulated and subjected to stastical analysis by one way ANOVA.

RESULTS

Table 1 Descriptive statistics

	N	mean	Std.deviation	Std.error	95% confidence inerval for mean		Minimum	Maximum
					Lower bound	Upper bound		
1	30	400.73	140.666	25.682	348.21	453.26	224	920
2	30	680.23	129.571	23.656	631.85	728.62	423	1081
3	30	793.50	155.902	28.464	735.29	851.71	526	1380
4	30	1023.00	294.351	53.741	913.09	1132.91	490	2000
total	120	724.37	294.168	26.854	671.19	777.54	224	2000

Table I shows descriptive statistics of all the three groups in which the mean retention force for control group is 400.73 g,group 1is 680.23g,and group 2 is793.50g,and group 3 is 1023g. The minimum and maximum retention forec values along with their Sd for all the three groups are 224-920±140.666g,423-1081±129.571g,526-1380±155.902g,490-2000±294.351g, respectively.



Graph 1 Mean retention force

Graph I shows the comparision between all the four groups in which group 4(stripform) shows the highest mean retention force value and the control group shows the lowest mean retention force value.

Table 2 Summary statistics of one way ANOVA

	Sum of squares	df	Mean square	F	significant
Between groups	6019427.133	3	2006475.711	54.404	0.0001
Within groups	4278182.733	116	36880.886		
total	1.030E7	119			

The mean values of all the four groups were subjected to one way analysis of variance (ANOVA) to determined the staststical level of significance.Table 2 shows the one way ANOVA statistics in which a highly statistical significance among all the four groups. p =0.0001,<0.05.

To evaluate which group comparison yielded the statistical significance, a post hoc test (Tukey test) was performed.

Table 3 Summary statistics of post hoc test (TukeyTest)

(I) VAR 00002	(J) VAR 00002	Mean Difference (I-J)	Std. Error	P VALUE	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-279.500*	49.586	0.0001	-408.75	-150.25
	3	-392.767*	49.586	0.0001	-522.02	-263.51
	4	-622.267*	49.586	0.0001	-751.52	-493.01
2	1	279.500*	49.586	0.0001	150.25	408.75
	3	-113.267	49.586	0.1081	-242.52	15.99
	4	-342.767*	49.586	0.0001	-472.02	-213.51
3	1	392.767*	49.586	0.0001	263.51	522.02
	2	113.267	49.586	0.1081	-15.99	242.52
	4	-229.500*	49.586	0.0001	-358.75	-100.25
4	1	622.267*	49.586	0.0001	493.01	751.52
	2	342.767*	49.586	0.0001	213.51	472.02
	3	229.500*	49.586	0.0001	100.25	358.75

*. The mean difference is significant at the 0.05 level.

On the basis of the results obtained the denture base with polygrip strip (group 3) shows maximum retention force followed by the denture base with fiftydent paste (group 2) and then denture base with fixon powder (group 1) The least retention force was observed with the control group.

Group 1 was compared with group 2,3,4, the result were -279.5, -392.7, -622.2, respectively; that shows the retention values for group 2,3,4 was always increased than the group 1.

Group 2 was compared with group 1,3,4, the results were 279.5, -113.2, -342.7; that shows the retention values for group 3,4 was higher than group 1, but lower than group 3,4.

Group 3 was compared with group 1,2,4, the results were 392.7, 113.2,-229.5; that shows the retention values for 3 was higher than group 1,2 but lower than group 4.

Group 4 was compared with group 1,3,4, the results were 622.2, 342.7, 229.5, respectively; that shows the retention values for group 4 was higher than group 1, group2, group3.

On the basis of the results obtained the denture base with polygrip strip form (group 4) shows maximum retention force followed by the denture base with Fixon supergrip paste (group 3) and then denture base with fix on powder (group 2). The least retention was obsereved with the control group.

DISCUSSION

Adequate retention is a basic requirement for the acceptance of complete dentures. Hence many patients frequently resort to the use of denture adhesives to increase the retention and stability of the complete denture which in turn improve the chewing and masticatory ability and also psycological well being of the patient.[4,5]

As the overdenture, implants, other mechanical devices are complicated option denture adhesives are introduced as an adjunct to denture treatment to improve sufficient retension of denture. However, the quantity and viscosity of saliva, oral mucosa, height and width of ridge, thickness of denture base all play important role on the retention of denture and effect of denture adhesives. vivo examination is needed for evaluation of retentive effect of denture adhesives. In present study the effect of three different denture adhesives on retentive effect of MCD was investigated.

Clinical evaluation of denture adhesives, measurement of dislodging force were required. The position of hook may effect the dislodgement force., we applied the hook to the centre of MCD as study by Kumar and Thombare.[8] similar study was done by N. J. Panchore et al, they used to place hook in middle of posterior land area and anterior block is attached in the crest of the ridge.[9]

In some vivo study for measuring dislodgement force, some gnathometer like disposable and non-disposable gnathometer were used.[10,11] Because the scale of the device may have less accuracy like scale euals a force of 10-12 N, the scores cannot be transform into universal units accurately. Other than gnathometer various instruments were used previously for measurement of dislodging force, but the mechanism was so complicated and they were not so accurate.[12] so, in present study we used Digital Dynamometer to measure dislodging force to check the retentive effects of denture adhesives.DD uses electronic technology with high precision load cell and electronic circuit for indicating force provide precise measurements. DD also used to chech bite force.[13]

The result of the study showed that strip form of adhesive and cream form adhesives have superior effects than powdwer forms of denture adhesive, due to different composition of materials. Powder forms of denture adhesives contain CMC (carboxymethyl cellulose) which provide a strong initial bond strength resulting in quick hold. In the presence of water, CMC hydrates that resulting in ionic adherence to dentures and mucosa. Morever the presence of the wax will disturb swelling and dissolution of CMC that provides good adhesion. In Fixon supergrip cream and Polygrip strips contains Polyvinylacetate, which is a sticky and insoluble material and provides longer holding effects.so, in case of poor and fair ridge cream form or strip forms can be used to provide effective retention of denture. This results also supports the similar article in which cream form of denture adhesives are more effectives than powder form.[14]

Various objective methods have been used for testing retention in the laboratory on models and also in patients mouth. Skinner [15]usedlaboratory procedure on model for applying dislodging force.Colon et al [16]used modified Whipmix ear-type face-bow attached to a spring gauge which measured the force applied by the operator. In this study we used used customized apparatus to support DD.Skinner[15] measure the amount of weight in the form of water to dislodge the denture bases. N.J. Panchore et al [17] used I.V. infusion tube. The head stabilizer of the OPG machine was used to stabilize the patient,s head as used in previous study.[9,17]

In thepresent study the mean retention force value was the maximum in group III-1023 g followed by group II-793 g and then group I-680 g. The least retention force was observed with the control group- 400.7g.

The reason for the strip form being more retentive is due to its composition and thickness and ease of application. Further study is required to check retention of denture as we checked retention in denture base. Also we can compaire the old and new denture retention. Patient,s feedback after a period of using the dentures with adhesives should also be considered.

CONCLUSIONS

Within the limitation of the this study, the following conclusions can be drawn:

1. Use of denture adhesives improved the retention.
2. use of poligrip strips was found to be the most effective denture adhesive.
3. The use of DD provides consistent results with previous studies.
4. Enhanced comfort, improved function, and in providing psychological satisfaction.

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