

CLINICAL COMPARISON OF RETENTION STRENGTHS OF TWO DENTURE ADHESIVES

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ABSTRACT

The objective of the study was to compare the mean increase in denture retention strength with paste and powder form of the denture adhesives, on mandibular complete denture.

It was a randomized control trial study and was carried out at the Prosthodontic Department of Lahore Medical and Dental College, Lahore from July 2014 to January 2015. Hundred patients wearing mandibular complete dentures having good polished, fitting and occlusal surfaces were included in the study. Patients having unstable denture or with soft liners tissue conditioners and with uncontrolled medical problem like uncontrolled diabetes mellitus, uncontrolled bleeding disorders, pemphigus, pemphigoid, lupus erythematosus were excluded. Fifty patients for group A were tested with denture adhesive powder and 50 patients for group B were tested with denture adhesive paste for their retention strengths. The retention strength values in grams were recorded by using spring scale. T-test was used to determine the existence of difference of mean retention strength b/w the two forms of denture adhesive. The results of the study have shown that there was significant difference in terms of mean increase in denture retention strength with paste form and powder form of denture adhesives ($P < 0.05$).

It was concluded that there was a significant improvement in the retention of mandibular complete denture after using both forms of denture adhesives. However the paste form of adhesive exhibited better retention strength as compared to powder form.

Key Words: Retention, complete dentures, denture adhesives.

INTRODUCTION

Effective complete denture rehabilitation is affected by the biomechanical phenomena of retention, support and stability.^{1,5} Adequate denture retention constitutes a basic and important prerequisite for the acceptance of complete denture by the patient.^{3,5} Occasionally, it is not possible to attain retention and stability especially in cases of extremely resorbed residual ridges.⁴ Residual ridge resorption is more pronounced in mandibular ridge as compared to maxillary and presents a challenge for prosthodontic rehabilitation.^{4,6} Surgical and/or prosthodontic treatments are available to improve

retention in cases of residual ridge resorption.^{1,4,16} Surgical treatments in the form of vestibuloplasty, ridge augmentation, and endosseous dental implants can improve retention and stability.^{2,5} Prosthodontic management include maximum coverage area during impression making, an intimate tissue/denture contact, an effective boarder seal and use of denture adhesives in the difficult and demanding patients.²

Denture adhesive is a material used to improve denture retention, decrease soft tissue discomfort and reduce the frequency of denture adjustments after the insertion.⁷⁻⁹ When properly administered, adhesives improve the interfacial surface tension occurring between the denture base and supporting soft tissues by improving the adhesive, cohesive, and viscosity characteristics of the interfacial film layer particularly in saliva-deficient patients.⁹ Furthermore they eliminate voids occurring in the interfacial space in the absence of absolute adaptation of the denture base to the bearing tissues.^{2,10} In addition to improved retention and stability, denture adhesives have been shown to reduce mucosal irritation, reduce food impaction beneath the denture base.¹¹⁻¹³ This result in the increase chewing efficiency, increase bite force, improve functional load

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distribution across the denture-bearing tissues, and facilitate the psychological well-being of the patient.^{14,17} Common indications for denture adhesives include immediate dentures, obturators, dry mouth, single complete dentures, poor ridge anatomy, poor neuromuscular control and in public like attorneys, actors and politicians.^{1,15,16}

Currently, the denture adhesives available can be divided into soluble and insoluble groups. Soluble groups include pastes, creams and powder while insoluble group include pads and wafers.^{1,2,13,17} Most of the previous studies on adhesives are either in vitro or based on patient satisfaction questionnaires. Limited in vivo studies on denture adhesives for their retention strength involve mostly maxillary denture or only paste form of adhesives.^{18,19} Literature concerning in vivo evaluation of retention strength of adhesive powder is inadequate.¹⁸ The present study is not only in vivo but also involves both forms of adhesives and retention strength will be evaluated on mandibular denture which has more retention problems as compared with maxillary denture.^{5,19}

There are different methods to measure the retention strength of complete denture include using gnathometer, hydraulic pulley, cineradiography, radio telemetry, etc.^{8,10,14,19} Because of their technique sensitivity and limitations, in current study a spring scale is used to measure denture retention strength which is less technique sensitive are relatively easy.^{8,19}

The objective of the current study was to find out the most retentive denture adhesive by comparing the retention strength of paste and powder form of denture adhesive so that the patient is able to get maximum benefit by choosing the best adhesive from the market. Furthermore the dentists shall be able to prescribe the best denture adhesive when the patient requires supplementary retention and stability.

METHODOLOGY

Patients with removable mandibular complete dentures, having good polished, fitting and occlusal surfaces were selected from department of Prosthodontics, Lahore Medical and Dental College, Lahore. Dentures with rocking or with soft liners tissue conditioners were excluded. Furthermore patients with uncontrolled medical problems like diabetes mellitus, bleeding disorders, pemphigus, pemphigoid, lupus erythematosus were also excluded. Duration of use and retention performance of denture would not affect the study results. This is because a minimum value of retention strength can be measured with every denture that is in use of patient.⁶ Demographic information like age and sex were recorded. Informed consent was taken from all the subjects for using their data

in research. Retention of dentures was measured by using a spring scale. All measurements were recorded in grams. Patients were divided into two groups by lottery method. First group A was tested with denture adhesive powder (Poligrip Ultra Wernets®) and the second group B was tested with denture adhesive paste (Corega super®).

The first measurement of retention of mandibular denture was made without any denture adhesive in both groups A and B for baseline retention strength. Patient with denture in his mouth was instructed to maintain maximum, non-forced intercuspation for five minutes. After this time, with mouth opened and lower lip relaxed in order to avoid losing peripheral seal, tip of spring scale was placed at the margin of denture, in recess of lingual frenum. Traction force was then applied until the denture detached, the maximum retention force being recorded by the spring scale. This procedure was repeated for three time and mean value was taken.

After recording retention of mandibular denture without denture adhesive, powder form was applied in group A patients and paste form was applied in group B patients. The same amount of denture adhesive was used in all tests in compliance with the instructions of the manufacturer. The denture was then placed in the mouth and the patient was again instructed to maintain maximum, non-forced intercuspation for 5 minutes. After this time force (in grams) was again recorded as described above. This procedure was repeated three times for each product in both groups without adding further amount of adhesive and waiting one minute in occlusion after each measurement and mean value was taken. Mean increase in denture retention strength was calculated by subtracting denture retention strength without adhesive from denture retention strength with adhesive for both study products. The obtained data was then used to compare powder and paste for their mean increase in retention strength. The bias in this study may include observation bias during recording the data by using spring scale. These biases were prevented by standardization of technique using a digital spring scale. Data was analyzed using SPSS version 17. The quantitative variables, age of the patients and retention strength was presented as mean \pm SD. The qualitative variable like sex was presented as frequency and percentage. T-test was used to determine the existence of difference of mean retention strength b/w the two forms of denture adhesive. P-value ≤ 0.05 was considered for significance.

RESULTS

One hundred patients of mandibular complete denture were divided into two groups of 50 each. In group A, 50 patients tested with denture adhesive powder and

in group B 50 patients tested with denture adhesive paste.

The mean ages of the patient in group A and B were 59.32 ± 9.16 years and 55.84 ± 8.80 years respectively. The majority of patients were in the age range of 51-60 years, 20 (40%) patients in tested with denture adhesive powder group and 23 (46%) patients in tested with denture adhesive paste group (Table 1). There were 33 males (66%) and 17 females (34%) in group A with male to female ratio was 1.9:1. While in group B there were 29 males (58%) and 21 females (42%) with male to female ratio 1.4:1 (Table 2).

TABLE 1: DISTRIBUTION OF PATIENTS BY AGE

| Age (years) | Group A (n=50) | | Group B (n=50) | |
|---------------|------------------|------|------------------|------|
| | No. | % | No. | % |
| 41-50 | 8 | 16.0 | 14 | 28.0 |
| 51-60 | 20 | 40.0 | 23 | 46.0 |
| 61-70 | 15 | 30.0 | 12 | 24.0 |
| 71-80 | 7 | 14.0 | 1 | 2.0 |
| Mean \pm SD | 59.32 ± 9.16 | | 55.84 ± 8.80 | |

TABLE 2: DISTRIBUTION OF PATIENTS BY SEX

| Sex | Group A (n=50) | | Group B (n=50) | |
|----------------------|----------------|------|----------------|------|
| | No. | % | No. | % |
| Male | 33 | 66.0 | 29 | 58.0 |
| Female | 17 | 34.0 | 21 | 42.0 |
| Male to female ratio | 1.9:1 | | 1.4:1 | |

TABLE 3: DISTRIBUTION OF PATIENTS BY PRE-PROCEDURE RETENTION STRENGTH

| Retention strength (grams) | Group A (n=50) | | Group B (n=50) | |
|----------------------------|--------------------|------|---------------------|------|
| | No. | % | No. | % |
| 23.33-100 | 20 | 40.0 | 24 | 48.0 |
| 101-200 | 22 | 44.0 | 10 | 20.0 |
| 201-300 | 6 | 12.0 | 8 | 16.0 |
| 301-400 | 2 | 4.0 | 8 | 16.0 |
| Mean \pm SD | 135.88 ± 77.89 | | 157.06 ± 112.09 | |

TABLE 4: DISTRIBUTION OF PATIENTS BY POST-PROCEDURE RETENTION STRENGTH

| Retention strength (grams) | Group A (n=50) | | Group B (n=50) | |
|----------------------------|---------------------|------|---------------------|------|
| | No. | % | No. | % |
| 175 – 400 | 22 | 44.0 | 3 | 6.0 |
| 401 – 800 | 28 | 56.0 | 36 | 72.0 |
| 801 – 1200 | — | — | 11 | 22.0 |
| Mean \pm SD | 439.09 ± 168.47 | | 679.26 ± 218.26 | |

TABLE 5: COMPARISON OF MEAN INCREASE OF DENTURE RETENTION STRENGTH B/W GROUP A AND B

| Mean difference (grams) | Group A (n=50) | | Group B (n=50) | |
|-------------------------|---------------------|------|---------------------|------|
| | No. | % | No. | % |
| 100 – 300 | 27 | 54.0 | 2 | 4.0 |
| 301 – 600 | 23 | 46.0 | 33 | 66.0 |
| 601 – 900 | — | — | 15 | 30.0 |
| Mean \pm SD | 303.21 ± 117.79 | | 522.19 ± 153.10 | |

$t = -8.016$, $df = 98$, $p = 0.000$

Mean difference = 218.98grams

The mean pre-procedure retention strength in group A tested with denture adhesive powder was 135.88 ± 77.89 grams and 157.06 ± 112.09 grams in group B tested with denture adhesive paste. The majority of patients were in the pre-procedure retention strength between 101-200 grams, 22 (44%) patients in group A. However in group B it was between 23.33-100 grams, 24 (48%) patients (Table 3).

The mean post-procedure retention strength in group A tested with denture adhesive powder was 439.09 ± 168.47 grams and 679.26 ± 218.26 grams in group B tested with denture adhesive paste. The majority of patients were in the post-procedure retention strength between 401-800 grams, 28 (56%) patients in group A and 36 (72%) patients in group B (Table 4).

The mean increase in denture retention strength in group A tested with denture adhesive powder was 303.21 ± 117.79 grams and 522.19 ± 153.10 grams in group B tested with denture adhesive paste. Statistically the difference between the two groups was significant ($P < 0.05$). The difference of mean increase in denture retention strength between group A and B was 218.98 grams (Table 5).

DISCUSSION

The hypothesis of the current study was that there is significant difference in terms of mean increase in denture retention strength with paste form and powder form of denture adhesives. The results of this study proved this hypothesis. The mean retention strength of paste form of adhesive was significantly higher than powder form of adhesive.

The results of this study showed that the mean retention strength in group A without adhesive (base line value) was 135.88 ± 77.89 grams while with adhesive powder (Poligrip Ultra Wernets®) it raised up to 439.09 ± 168.47 grams. So denture's mean retention strength improved 303.21 ± 117.79 grams. Similarly Komar et al¹¹ in their in vivo study found that mean denture retention strength value was (836 \pm 48 grams) without any denture adhesive while this value was

(2044±104 grams) with powder form of adhesive and (3072±99 grams) with paste form. Salman and Ibrahim²⁰ in their study found that the mean retention strength of denture without adhesive was 841.1±224.68 grams while denture retention strength was 1567.2±418.6 grams with adhesive powder and 1684.4±447.4 grams with adhesive paste.

The results of current study coincide with the results of both above mentioned studies. However, in contrast to the present study they involved upper dentures and also different brands of adhesives which tend to show better retention than mandibular dentures and this may explain the difference in results.

In the present study the mean retention strength in group B without adhesive was 157.06±112.09 grams while after application of adhesive paste (Corega super®) it was raised up to 679.26±218.26 grams. So, mean retention strength improved 522.19±153.10 grams with adhesive paste.

To make a comparison between mean retention strength of powder denture adhesive and paste denture adhesive t-test was used. Results of the test showed statistically significant difference ($P < 0.05$) which proved the hypothesis of this study. Paste denture adhesive had better mean retention strength, 218.98 grams more than powder denture adhesive.

The results of current study also coincide with study of Chowdhry et al⁷ but their study was in vitro. This in vitro study confirmed that paste form of adhesive material was more resistant to dislodgement than powder. They used various adhesive materials in combination with saliva and results showed that paste adhesives with saliva showed maximum retentive ability up to 461.44 grams while the retentive ability of powder adhesive was up to 333.12 grams.

Similar results was demonstrated by Chew¹² and was later confirmed by Ghani and Picton¹³ who demonstrated that the liquid/paste form of denture adhesive rendered the ill-fitting dentures almost as retentive as well fitting one and is better than powder form. This has been attributed to the increased viscosity of the paste materials as opposed to the powder forms.⁹ Ghani and Picton¹³ claimed six times improvement in denture retention as compared to baseline. Mean increase in denture retention is less as compared to results of this study. This is, because they checked the retention of maxillary denture which mostly exhibit better retention as compared mandibular complete denture.

This study is helpful for those dentists who are doubtful about the true efficacy of adhesive, and are not certain about which adhesives offer the best retention performance.^{18,19} The present study proved the efficacy of both paste and powder forms of adhesives by

comparing the retention strength of denture without adhesives and with adhesives. This study also explored which form of adhesive is the most retentive.

Although many authors claim that denture adhesives improve denture stability and retention, almost all the research published in the literature comprises of in vitro studies and/or is based on the subjective assessment patients by patient satisfaction questionnaires.^{16,20} Limited in vivo studies carried out to date, mostly involve the upper complete denture, and only a few studies have been done on lower complete denture for checking retention strength of adhesive.¹⁶⁻²⁰ The current study was not only in vivo but involved mandibular complete denture which poses greater retention problems as compared to maxillary denture.

One of the problems associated with studies of this kind is the need for a system capable of registering retention, with simple handling characteristics and good patient tolerance. In this study we used a very simple spring scale that proved comfortable for the patients. Traction is applied to the anterior zone of the dentures, which may be interpreted as a source of error in terms of the quantification of retention. Nevertheless, this problem is not important provided peripheral sealing of the dentures is maintained.

This kind of research can be more reliable and practical when following factors are considered/ incorporated:

- 1 An increased sample size
- 2 Investigation of the effects of denture adhesives over certain time period
- 3 Selection of an accurate methods to measure denture retention strength
- 4 Additional methods to investigate denture performance (radiotelemetry, cineradiography, retentionometers).

CONCLUSION

The following conclusion can be obtained from the current study;

- 1 Both adhesive either paste or powder can increase denture retention significantly.
- 2 Mandibular complete denture exhibited significantly higher retention with both products as compared to retention without any denture adhesive.
- 3 The paste form of denture adhesive was observed to be more resistant to dislodgement than the powder.

Denture adhesive increases the retention of removable complete denture significantly. Denture adhesive should be recommended to difficult and demanded pa-

tient like, immediate dentures, obturators, dry mouth, single complete dentures, poor ridge anatomy and in public like attorneys, actors and politicians, vocalist and in patients with systemic diseases like Parkinson's disease, Alzheimer disease. However patients using denture adhesives should be educated regarding pros and cons of such material.

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