Original Article

An In Vivo Estimation Of Retention Efficiency Of Three Powdered Denture Adhesives In Maxillary Single Complete Denture Of Institutionalized Patients: An Original Research Study

Naveen Kumar[1], Snigdha Shree[2], Anu Sharma[3], Mohit Bansal[4], Sunithakollu[5], Tarannum Alam Shaikh[6]

[1]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Rama Dental College Hospital & Research Centre, Kanpur, Uttar Pradesh, India
[2]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, Rama Dental College Hospital & Research Centre, Kanpur, Uttar Pradesh, India
[3]Senior Lecturer, Department of Prosthodontics and Crown & Bridge, National Dental College, Derabassi, Punjab, India
[4]Reader, Department of Conservative Dentistry and Endodontics, Swami Devi Dyal Dental College and Hospital, Barwala, India
[5]Associate Professor, Department of Prosthodontics and Crown & Bridge, Mamata Dental College, Khammam, Telangana, India
[6]Post Graduate Student, Department of Prosthodontics and Crown & Bridge, National Institute of Medical Science Dental College & Hospital, Jaipur, India

Corresponding Author: Snigdha Shree, Post Graduate Student,
Department of Prosthodontics and Crown & Bridge, Rama Dental College Hospital & Research Centre, Kanpur, Uttar Pradesh, India,
Email: siniup95@gmail.com
DOI: 10.47750/pnr.2023.14.S02.181

Abstract

Background and Aim: Denture adhesives were introduced in the field of dentistry with the prime endeavor of providing retention to loose dentures. Currently several brands and forms of denture adhesives are available for denture wearers. However, selection of the perfect adhesive is highly subjective and must be done very carefully. This in vivo study was conducted to assess the retention efficiency of three powdered denture adhesives in maxillary single complete denture of institutionalized patients.

Materials and Methods: This study included total 60 patients in which maxillary single complete denture were constructed in last two years. Three commercially available denture adhesives (Fixon, Poligrip, Fittydent) were studied for their retention performance. All patients were divided into three groups of 20 each with respective adhesives. Group 1 utilized powder Fixon, Group 2 utilized powder Poligrip and Group 3 utilized powder Fittydent for retaining their maxillary complete denture. The measurements were attempted after one month of successful wearing of the denture. Readings were taken separately at 1 hour, 2 hour, 3 hours and 4 hours post wearing by digital force gauge. The metallic hook tip of force gauge was engaged in the labial sulcus for seeing the force. P values less than 0.05 was considered as significant.

Statistical Analysis and Results: Total 17 were in the age group of 46-50 years, 28 subjects were of 51-55 years of age, 11 were 56-60 years of age and 4 patients were of age 61-65 years. P value was reported to be significant for first age group (0.02). For Group 1 the statistical mean at 1 hour, 2 hours, 3 hours and 4 hours were 2.43, 2.65, 2.76 and 2.23 respectively. For Group 2 the statistical mean calculated at 1 hour, 2 hours, 3 hours and 4 hours were 1.93, 2.25, 2.02 and 2.12 respectively. For Group 3 the statistical mean at 1 hour, 2 hours, 3 hours and 4 hours were 3.32, 3.02, 2.71 and 2.36 respectively. Comparison among the three study groups using one-way ANOVA revealed highly significant values for level of significance (0.001).

Conclusion: Within the limitations of the study, authors concluded that denture adhesive unquestionably increases the retention performance of the maxillary complete denture. In the present study, Fittydent powder showed higher retention when compared to other two tested adhesives. Poligrip powder showed minimum retention among all three adhesives. However, the variation in the acceptance and familiarity of the denture adhesives among population needs to be sought.

Keywords: Fixon, Poligrip, Fittydent, Denture Adhesives, Retention

Introduction

The primary aim of any oral rehabilitation therapy is to increase the form and function of the oral and maxillofacial structures. The complete denture is the most widely used dental prosthesis worldwide by completely edentulous patients.[1,2] Many of the researchers have confirmed the main role of denture adhesive in trial bases at jaw relation, immediate dentures, reconstruction or pre-prosthetic surgery, psychological aid, poor anatomic structures, physically/mentally retarded patients, xerostomia. Literature has well evidenced that fabrication and usage of the complete denture is highly subjective.[3,4] It solely depends upon various patients and related factors. As per the statement of Coates, 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.[5] Most of the denture adhesives have somewhat similar chemical constituents. In the recent times, denture adhesive have been extensively experimented and tested for their better performances. Older denture adhesives were made from vegetable gums like acacia, tragacanth, or karya. They mainly worked by adsorbing the water to form a mucilaginous layer between the denture-bearing tissue and the denture base.[6,7] However, these entities were highly soluble in the oral environment and dissolve readily making it useful for a short time span only. Therefore, this in vivo study was conducted to assess the retention efficiency of three powdered denture adhesives in maxillary single complete denture of institutionalized patients.

Materials and Methods

This study was completed on 60 patients in which maxillary single complete denture were fabricated in last two years. Inclusion criteria included a) patients with existing maxillary single complete denture fabricated in the institution itself b) patients with complete natural dentition in the lower arch with no major dental or skeletal problem c) patients with moderate to high well rounded edentulous ridge in maxillary arch d) no sign and symptom of infection, inflammation, abscess, pain, flabby ridges. Exclusion criteria included a) patients with possibility of loss of follow up b) patients with gross anomaly in the lower or upper ridge c) patients with known systemic complication. Informed consent had been obtained from all patients. Three commercially available denture adhesives were studied for their retention performance. These were Fixon, Poligrip, Fittydent. Only powder form of these denture adhesives has been studied. All 20 patients of Group 1 utilized powder Fixon for retaining their maxillary complete denture. Similarly, all 20 patients of Group 2 utilized powder Poligrip for retaining their maxillary complete denture. Likewise, all 20 patients of Group 3 utilized powder Fittydent for retaining their maxillary complete denture (figure 1). Patients were asked to clean their upper denture first before applying the adhesive. The patients were instructed to apply little amount of the adhesive on a previously prefixed areas on tissue surface. The used quantity varies from 0.10 to 0.70 g depending on the physical preparation of the adhesive and on the size of the upper denture. The actual measurements and recordings were attempted after one month of successful wearing of the denture. For each patient, five different recordings were done at four different timings. Average of all five readings was taken individually at 1 hour, 2 hour, 3 hours and 4 hours post wearing. Digital force gauge was used to check the force of dislodgment against its path of insertion (perpendicular dislodging force expressed in Newton). The metallic hook tip of force gauge was engaged in the labial sulcus of right side to record the force. Immediately before the implementation of the study, author had explained the relative importance of this study to all participating patients. The privacy and other interrelated rights of the patients along with their freedom of expression were kept absolutely confidential. The recorded data was subjected to suitable

statistical tests to obtain p values, mean and other statistical parameters. P values less than 0.05 was considered as significant.

Statistical Analysis and Results

All the measured data were complied in methodical way and subjected to appropriate statistical analysis using SPSS statistical package for the Social Sciences version 22 for Windows. We had separated the patients into 4 different groups depending on their age range. Out of the total studied size of 60 patients who participated in the study, 17 were in the age group of 46-50 years, 28 subjects were of 51-55 years of age, 11 were 56-60 years of age and 4 patients were of age 61-65 years. P value was reported to be significant for first age group (0.02). On the whole, we had 40 male and 20 female subjects (Table 1-2 & Graph 1). Table 3 describes about fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 1 Fixon [n=20]. The statistical mean calculated at 2 hours showed highly significant p value (0.020). Similarly, the statistical mean calculated at 3 hours showed highly significant p value (0.010). Overall the mean values at all four timings were nearer only. The statistical mean at 1 hour, 2 hours, 3 hours and 4 hours were 2.43, 2.65, 2.76 and 2.23 respectively. Table 4 describes about fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 2 Poligrip [n=20]. The statistical mean calculated at 2 hours showed highly significant p value (0.010). However, other statistical mean calculated at 1,3,4 hours were not significant. Overall the mean values at all four timings were closer only. The statistical mean at 1 hour, 2 hours, 3 hours and 4 hours were 1.93, 2.25, 2.02 and 2.12 respectively. Table 5 describes about fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 3 Fittydent [n=20]. The statistical mean calculated at 1 hours showed highly significant p value (0.010). However, other statistical mean calculated at 2,3,4 hours were not significant. In general the mean values at all four timings were closer only. The statistical mean at 1 hour, 2 hours, 3 hours and 4 hours were 3.32, 3.02, 2.71 and 2.36 respectively. Table 6 is showing comparison among the three study groups using one-way ANOVA [for group 1,2,3]. It revealed highly significant values for level of significance (0.001).

Table 1: Age & gender wise allocation of patients

Age Group (Yrs)	Male	Female	Total	P value
46-50	8	9	17	0.02*
51-55	22	6	28	0.07
56-60	7	4	11	0.08
61-65	3	1	4	0.01*
Total	40	20	60	*Significant
***p<0.05 significant**				

Table 2: Patients distribution according to gender: statistical evaluation using student's t-test

Student's t-test				
Gender	**Number [n]**	**Statistical Mean**	**SD**	**P value**
Male	40	2.34	1.230	0.002*
Female	20	2.76	1.342	
***p<0.05 significant**				

Graph 1: Age range and gender wise distribution of patients

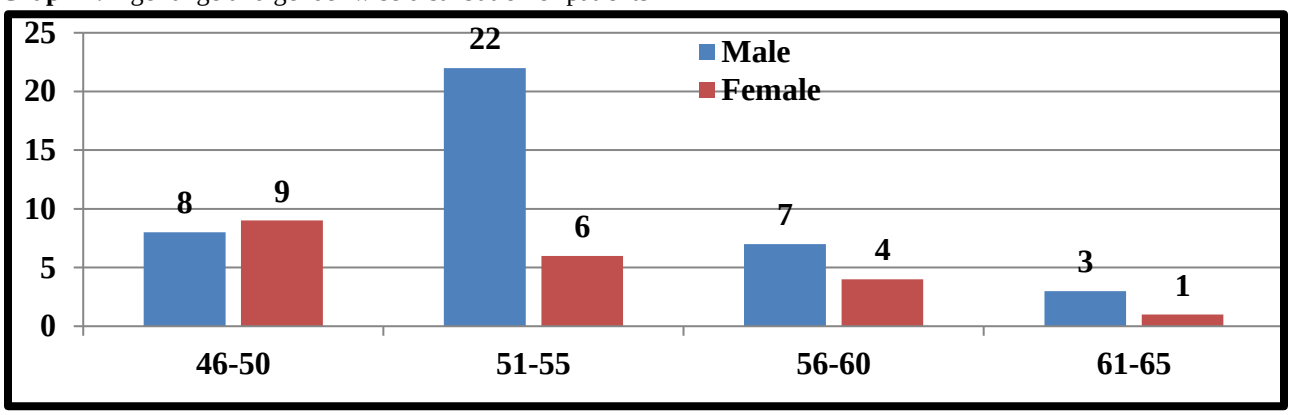

Table 3: Fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 1 Fixon [n=20]

Time Intervals	Statistical Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
1 Hours	2.43	0.563	0.325	1.96	2.345	1.0	0.054
2 Hours	2.65	0.434	0.456	1.96	2.124	2.0	0.020*
3 Hours	2.76	1.346	0.877	1.96	2.786	1.0	0.010*
4 Hours	2.23	0.786	0.356	1.96	1.556	1.0	0.090
***p<0.05 significant**							

Table 4: Fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 2 Poligrip [n=20]

Time Intervals	Statistical Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
1 Hours	1.93	0.938	0.334	1.02	2.632	1.0	0.090
2 Hours	2.25	0.403	0.403	1.74	2.102	2.0	0.010*
3 Hours	2.02	0.832	0.832	1.96	2.732	1.0	0.800
4 Hours	2.12	0.753	0.303	1.90	1.033	2.0	0.060
***p<0.05 significant**							

Table 5: Fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test For Group 3 Fittydent [n=20]

Time Intervals	Statistical Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
1 Hours	3.32	0.637	0.527	1.32	2.831	1.0	0.010*
2 Hours	3.02	0.402	0.499	1.04	2.193	2.0	0.210
3 Hours	2.71	0.536	0.244	1.56	2.433	1.0	0.100
4 Hours	2.36	0.764	0.336	1.10	1.063	2.0	0.560
***p<0.05 significant**							

Table 6: Comparison among the three study groups using one-way ANOVA [for group 1,2,3]

Variables	Degree of Freedom	Sum of Squares ∑	Mean Sum of Squares m∑	F	Level of Significance (p)
Between Groups	4	2.536	1.039	2.1	0.001*
Within Groups	20	6.939	0.435	-	
Cumulative	122.03	10.312	***p<0.05 significant**		

Figure 1: Three commercial denture adhesives used in the study [powder form]

Discussion

Retention of denture is greatly affected by different factors such as adhesion, cohesion, interfacial surface tension, mechanical locking into undercuts, peripheral seal, atmospheric pressure and orofacial structures. Denture adhesives are primarily used to increase the retention and stability of complete dentures particularly with poor ridges. Literature has shown that newly made dentures could be a frustration to a patient because of poor fit and repeated dislodgments.[8,9] The use of denture adhesives in complete dentures may be logical only when retention and stability is not achievable. Denture adhesives can also be used when implants are not an option because of the economical issues, systemic

conditions, or personal choice. Additionally, many denture wearers use denture adhesives as a readymade way to increase the retention and stability.[10,11] Denture adhesives assist denture patients by increasing fit, comfort, chewing capability and self-assurance. Denture adhesives are found beneficial by most of the edentulous patients but dental practitioners have been resistant to accept them as a quicker way of increasing retention, stability and function. Undoubtedly, patients who keep on using poorly-fitting dentures for longer time can face other oral issues like taste perception. In our study, all the three types of denture adhesives instantly started increasing the retention o maxillary single complete denture.[12,13] Fittydent provides strong bio-adhesive 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 hence it increases the retention of maxillary single complete dentures.

Conclusion

Within the limitations of the study, authors concluded that denture adhesive increases the overall retention performance of the maxillary complete denture undoubtedly. Here, Fittydent powder showed higher retention when compared to other two tested adhesives. Poligrip powder showed minimum retention among all three adhesives. So, Fittydent powder is seems to hold the denture for longer time even with moderate maxillary ridges. Optimal denture retention is directly related to the patient satisfaction and self confidence. However, inferences of the study should be clinically correlated before applying in clinical setups. More studied needs to be conducted to validate these recommendations and suggestions.

References

1. Slaughter A, Katz RV, Grasso JE. Professional attitudes toward denture adhesives: A Delphi technique survey of academic prosthodontists. J Prosthet Dent. 1999;82(1):80–9.
2. Duqum I, Powers KA, Cooper L, Felton D. Denture adhesive use in complete dentures: Clinical recommendations and review of the literature. Gen Dent. 2012;60(6):467–77. quiz p 478.
3. Kapur KK. A clinical evaluation of denture adhesives. J Prosthet Dent. 1967;18:550–8.
4. Figueiral MH, Fonseca PA, Pereira-Leite C, Scully C. The effect of different adhesive materials on retention of maxillary complete dentures. Int J Prosthodont. 2011;24(2):175–7.
5. Coates AJ. Usage of denture adhesives. J Dent. 2000;28(2):137–40.
6. Chew CL, Phillips RW, Boone ME, Swartz ML. Denture stabilization with adhesives: A kinesiographic study. Compend Contin Educ Dent. 1984;(Suppl 4):S32–8.
7. Panagiotouni E, Pissiotis A, Kapari D, Kaloyannides A. Retentive ability of various denture adhesive materials: An in vitro study. J Prosthet Dent. 1995;73(6):578–85.
8. Chowdhry P, Phukela SS, Patil R, Yadav H. A study to evaluate the retentive ability of different denture adhesive materials: An in vitro study. J Indian Prosthodont Soc. 2010;10(3):176–81.
9. Abdelmalek RG, Michael CG. The effect of denture adhesives on the palatal mucosa under complete dentures. A clinical and histological investigation. Egypt Dent J. 1978;24(4):419–30.
10. Adisman IK. The use of denture adhesives as an aid to denture treatment. J Prosthet Dent. 1989;62(6):711–5.
11. Ikemura N, Sato Y, Furuya J, Shimodaira O, Takeda K, Kakuta T, Yamane K, Kitagawa N. Changes in denture retention with denture adhesives and oral moisturizers for the oral cavity: an in vitro study. BMC Oral Health. 2021 Sep 8;21(1):438.
12. Nishi Y, Nomura T, Murakami M, Kawai Y, Nishimura M. Effect of denture adhesives on oral moisture: A multicenter randomized controlled trial. J Prosthodont Res. 2020 Jul;64(3):281-288.
13. Quiney D, Nishio Ayre W, Milward P. The effectiveness of adhesives on the retention of mandibular free end saddle partial dentures: An in vitro study. J Dent. 2017 Jul;62:64-71.