

Original Research

An analytic study to compare and evaluate the efficacy of four denture adhesives in edentulous patients: A randomised control trial

¹Hilal Ahmad Hela, ²Shabir Ahmad, ³Sandeep Kour Bali, ⁴ShazanaNazir, ⁵Mohammad Arif Lone, ⁶Nazia Majeed Zarger

¹PG Student, ³Professor and Head, ⁴Assistant Professor, ^{5,6}Lecturer, Department of Prosthodontics, GDC Srinagar, Jammu and Kashmir, India

²Professor and Head, Department of Dental Materials, GDC Srinagar, Jammu and Kashmir, India

ABSTRACT:

Background and aim: Complete dentures forms one of the most important treatment modalities in an edentulous patient making stability and retention a basic requirement to the success of the removal prosthesis. These two properties of complete denture usually worsen in patients with resorbed ridges. To overcome these, dental adhesive are commonly recommended by the specialist to increase the stability and retentive properties of the denture. However, a little is known about the efficacy of these materials. Thus, the main aim of the study was to evaluate and compare the efficacy of commercially available four different denture adhesive in relation to their retentive properties. **Material and methodology:** randomized 100 edentulous subjects with resorbed mandibular ridge were selected from the general OPD of the department of prosthodontics. After the fabrication of the denture, subjects were randomly divided into four groups with 25 patients in each group. In group I: FITYDENT adhesive was used for the retention, in group II: ISABGOL adhesive was used, in group III: FIXON powder and group IV: SECURE cream was used for the retention of the mandibular dentures. The cohesion and adhesion which developed between the underlying mucosal tissue and denture with adhesive was evaluated using a digital force gauge apparatus at three different time of adaptation period. **Results:** Statistical analysis and inter and intragroup comparison was done using student t test and ANOVA with two tailed p-value. Fitydent proved to be the best denture adhesive among the four denture adhesive compared with highly statistically significant results. **Conclusion:** Within the limitations of the study it can be concluded that all the three commercially available denture adhesives were found to efficient in providing stability and retention to the dentures with the resorbed ridges. The mean retention was found to be of the order **fit tydent \geq is a bgol > secure > fixon.**

Keywords: adhesives, denture, edentulous ridge, mandible, retention.

Received: 22 December, 2022

Accepted: 25 January, 2023

Corresponding author: Hilal Ahmad Hela, PG Student, Department of Prosthodontics, GDC Srinagar, Jammu and Kashmir, India

This article may be cited as: Hela HA, Ahmad S, Bali SK, Nazir S, Lone MA, Zarger NM. An analytic study to compare and evaluate the efficacy of four denture adhesives in edentulous patients: A randomised control trial. *J Adv Med Dent Scie Res* 2023;11(2):39-45.

INTRODUCTION

Retention of dentures is defined as “the resistance of denture to dislodge,” by the glossary of prosthodontic terms (GPT).¹ The retention of a complete denture is usually influenced by the number of variables including physical, physiological, psychological, surgical and mechanical.² Severely atrophied edentulous ridges, xerostomia, patients lacking neuromuscular control, severely hypertrophied tissue, maxillofacial defects with inadequate tissue support can affect the stability and retention of the dentures.³

The denture bearing area of mandibular ridges are comparatively less than that of the maxillary ridges which further worsens the situation in patients with already resorbed ridges. Apart from the area, the shape, size and position of the tongue also influence the retention and stability of the dentures. Implant supported prosthesis and over dentures can become an alternative of such situations and can provide patients with more stable and retentive prosthesis. However, the time and cost requirements for such treatment modalities when compared to conventional removal

denture are enormous and thus, limiting their use.⁴ Thus, a denture adhesive can be recommended for enhancing the qualitative properties of stability and retention.

Denture adhesive possess a very important space in conventional prosthodontics. They are commercially popular due to its soluble, non-sticky and non-irritating capabilities which when applied over the tissue surface can enhance the quality of denture by increasing the stability and retention.⁵ Though these adhesive are easily available and commonly used, clinicians usually don not recommend their usage in routine dental practice which reflects the poor clinical and prosthetic skills. Denture adhesives are available in the form of paste or creams, foam, powder and wafers or strips.³ **Shay** in 1991, explained the mechanism of dental adhesion. According to him the material swells in volume (50-150%) when in contact with water, which inturn fills the space between the prosthesis and the tissues. These adhesives increase the viscosity of saliva along with the interface between the mucosal tissues and tissue bearing area of the denture, thus help in aiding the peripheral seal.⁶ Although the role of denture adhesive and their efficacy has been well documented in numerous literatures, however the disadvantages and the problems associated were not known until the presence of zinc in denture adhesive came into light. Many adhesives such as Fixodent, and Poligrip contained a large amount of zinc which reported to be associated with hyperzincemia characterized by elevation of serum zinc levels and depression of serum copper. Low serum copper levels were further associated with bone marrow depression and widespread motor and sensory neuropathies along with decreased retentive ability over a short period of time.^{7, 8} A large number of zinc free formulations are available and thus an attempt was made to evaluate and compare the efficacy of **ISABGOL** granules, a commonly prescribed laxative as a denture adhesive, **FITTYDENT** paste, **FIXON** powder and **SECURE** cream.

MATERIAL AND METHDOLOGY

Randomized 100 subjects of the age 50 years and above, with resorbed mandibular ridge of the order 5 (ATWOODS CLASSIFICATION)⁹ were selected from the general OPD in the department of Prosthodontic, Crown and Bridge of Government Dental College, Srinagar. All the covid protocols were followed before any examination of the subjects. The subjects with no history of allergy, any neuromuscular or joint disorders, bony projections, enlarged tongue, xerostomia, and systemically healthy subjects were included in the study. Before any enrollment, the subjects were briefly discussed about the procedure and the recalled period for the completion of the study. After the complete satisfaction and agreement for inclusion in the study, the subjects were asked to sign an informed consent.

All the edentulous patients underwent complete oral and mucosal examination. Subjects with any ulceration, bony spicule, epulis or any enlargement were excluded from the study. After the examination, patients were asked to rinse the mouth properly with 0.12% Chlorhexidene mouthwash for impression making. Conventional denture fabrication procedures were used and patients were recalled for the insertion of the denture. On the lingual side of the mandibular denture a pre-fabricated stainless steel hook was inserted and fabrication of the denture was completed. The denture was place in water at room temperature before the insertion. Patients were recalled for testing and denture insertion. On the day of insertion patients were randomly selected for inclusion in any of the four groups.

GROUP I: FITTYDENT PASTE (Dr. Reddy Lab. Ltd. Hyd.)

GROUP II: ISABGOL GRANULES (Organic India IsabgolPsyllium Husk, Guj)

GROUP III: FIXON POWDER (ICPA Mumbai)

GROUP IV: SECURE (Group Phrma. Ltd. Bengl.)

The patients were seated comfortably in upright position and were made to rinse their mouth with water. Patients were trained to inform about the denture loosening. Dentures were inserted and patients were helped to close in centric occlusion and left it in position for at least 2 minutes. Immediately after the insertion of the denture, retention was assessed using digital force gauge and values were recorded. Before the delivery of the denture, denture adhesive were used and again the retention and stability of the denture was evaluated. The procedure was repeated twice with half an hour gap in between. The tissue surface of the denture was cleaned after the experiment with an aqueous solution of soap. The dentures were thoroughly washed and all particulate and traces of adhesives were carefully removed followed by drying the surface with the absorbent filter paper or tissue paper. This would help in removing any effects of previous adhesive application between the treatment and bias free recording of the readings. Same procedure was followed in all the patients with different adhesive and readings were recorded. The patients were instructed on the usage of the denture adhesive and post insertion instructions were given. The patients were recalled after 1 month and 3 months for recording the stability and evaluation of the tissues.

STATISTICAL ANALYSIS

The recorded data was analyzed and transferred into Microsoft excel. SPSS software version 20.0 was used for the statistical analysis of the study. Descriptive analysis was done using frequencies, percentages, mean and standard deviation, while the intragroup and intergroup comparisons were done using student t-test and ANOVA test (test of variance) with two tailed p-value of 0.05.

RESULTS

Table 1: representing the demographic analysis of the study patients						
Parameters		Frequency (n)	Percentage (%)	Mean±sd	Minimum	Maximum
Age	50-60	55	55%	60.620±7.479	50.000	80.000
	61-70	35	35%			
	71-80	10	10%			
	Total	100	100%			
Gender	Male	75	75%	1.250±0.435	1.000	2.000
	Female	25	25%			
	Total	100	100%			

Table 2: comparison of mean retention (in newton) values of mandibular dentures in group i immediately, after month and 3 months with and without adhesive. (fittydent)				
Group	Retention	Mean±sd	P-value	Significance
Without adhesive	Immediately	9.21±1.08	<0.0001*	HS
	After 3 months	28.02±1.02	<0.0001*	HS
Group I	Immediately	22.6±1.05	<0.0001*	HS
	After 1 month	25.8±1.65	<0.0001*	HS
	After 3 months	28.02±1.02	<0.0001*	HS

HS: Highly Significant, *statically significant.

Table 3: comparison of mean retention (in newton) values of mandibular dentures in group ii immediately, after month and 3 months with and without adhesive. (isbagol)				
Group	Retention	Mean±sd	P-value	Significance
Without adhesive	Immediately	7.21±1.98	<0.02	S
	After 3 months	21.2±1.92	<0.0001*	HS
Group II	Immediately	20.9±1.58	<0.0001*	HS
	After 1 month	19.8±1.06	<0.0001*	HS
	After 3 months	21.2±1.92	<0.0001*	HS

HS: Highly Significant, *statistically significant.

Table 4: comparison of mean retention (in newton) values of mandibular dentures in group iii immediately, after month and 3 months with and without adhesive. (fixon)				
Group	Retention	Mean±sd	P-value	Significance
Without adhesive	Immediately	8.23±1.22	0.04*	S
	After 3 months	20.03±1.68	<0.04*	S
Group III	Immediately	25.01±1.67	<0.0001*	HS
	After 1 month	21.08±1.55	<0.0001*	HS
	After 3 months	20.03±1.68	<0.04*	S

S: Significant, HS: Highly Significant, *statistically significant.

Table 5: comparison of mean retention (in newton) values of mandibular dentures in group iv immediately, after month and 3 months with and without adhesive. (secure)				
Group	Retention	Mean±sd	P-value	Significance
Without adhesive	Immediately	7.02±1.25	0.01	S
	After 3 months	17.05±1.05	1.02	NS
Group IV	Immediately	22.25±1.56	<0.001*	S
	After 1 month	15.08±0.25	<0.002*	S
	After 3 months	17.05±1.05	1.02	NS

S: Significant, NS: Non Significant, *statistically significant.

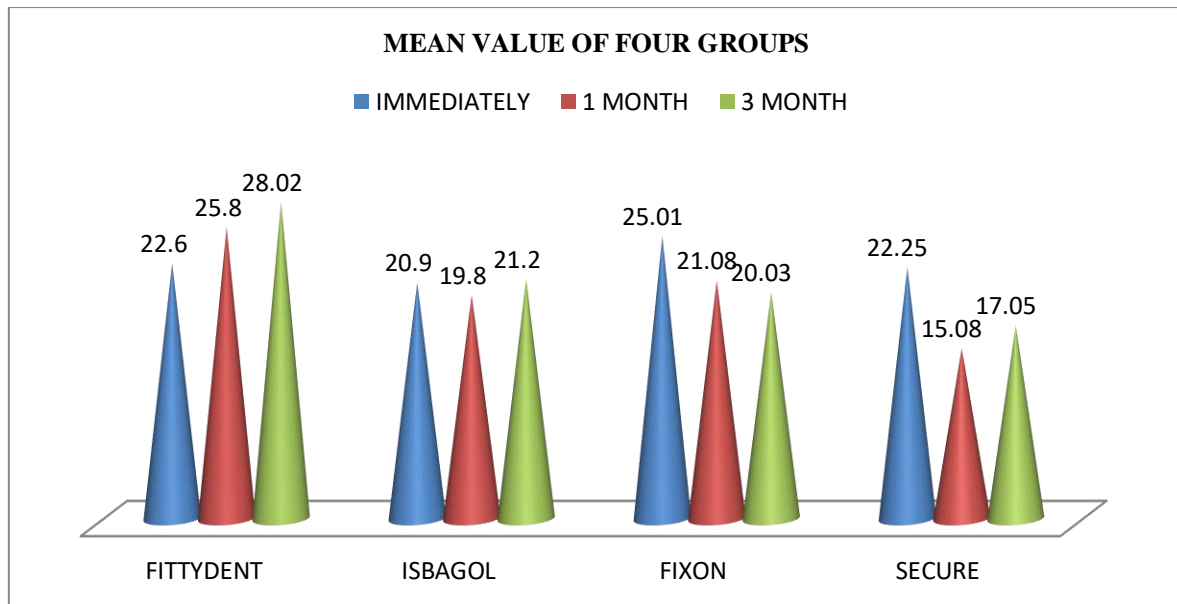


Table 6: comparison of mean retention values of mandibular dentures within four groups immediately after insertion

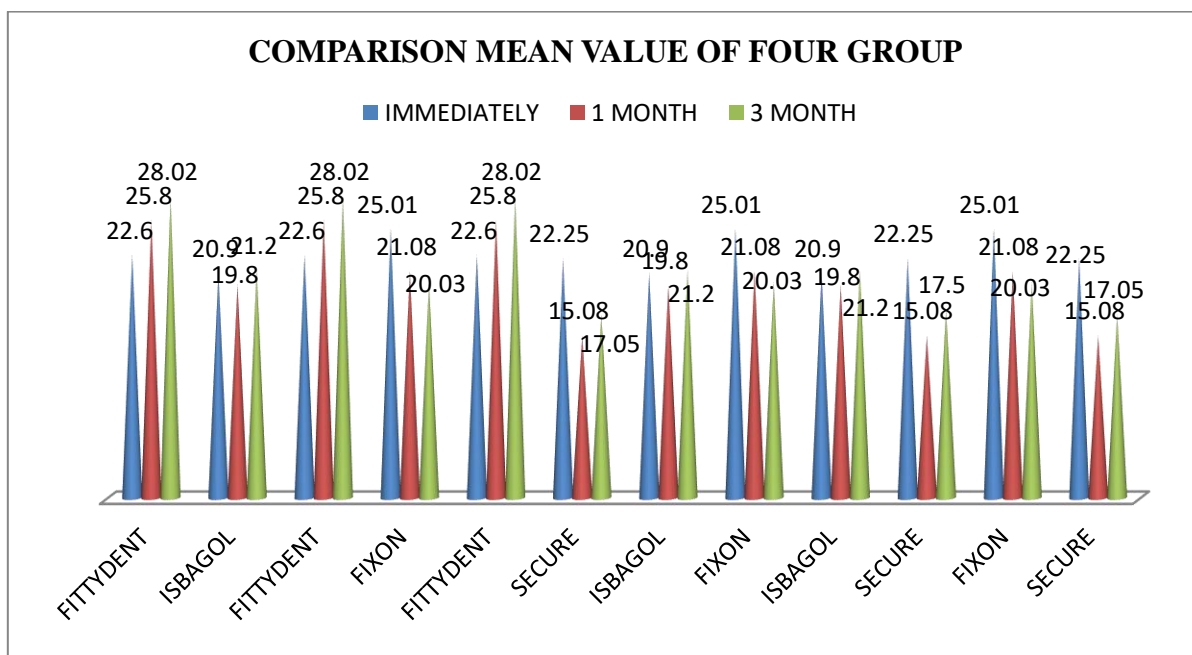
Group	Mean±sd	P-value	Significance
Fittydent	22.6±1.05	<0.0001*	HS
Isbagol	20.9±1.58		
Fittydent	22.6±1.05	<0.0001*	HS
Fixon	25.01±1.67		
Fittydent	22.6±1.05	<0.0001*	HS
Secure	22.25±1.56		
Isbagol	20.9±1.58	0.01	S
Fixon	25.01±1.67		
Isbagol	20.9±1.58	0.02	S
Secure	22.25±1.56		
Fixon	25.01±1.67	0.53	NS
Secure	22.25±1.56		

Table 6: comparison of mean retention values of mandibular dentures within four groups 1 month after insertion

Group	Mean±sd	P-value	Significance
Fittydent	25.8±1.65	<0.0001*	HS
Isbagol	19.8±1.06		
Fittydent	25.8±1.65	<0.0001*	HS
Fixon	21.08±1.55		
Fittydent	25.8±1.65	<0.0001*	HS
Secure	15.08±0.25		
Isbagol	19.8±1.06	0.01	S
Fixon	21.08±1.55		
Isbagol	19.8±1.06	0.02	S
Secure	15.08±0.25		
Fixon	21.08±1.55	0.53	NS
Secure	15.08±0.25		

Table 9: comparison of mean retention values of mandibular dentures within four groups 3 month after insertion

Group	Mean±sd	P-value	Significance
Fittydent	28.02±1.02	<0.0001*	HS
Isbagol	21.2±1.92		
Fittydent	28.02±1.02	<0.0001*	HS
Fixon	20.03±1.68		
Fittydent	28.02±1.02	<0.0001*	HS
Secure	17.05±1.05		
Isbagol	21.2±1.92	0.23	NS
Fixon	20.03±1.68		
Isbagol	21.2±1.92	0.01	S
Secure	17.05±1.05		
Fixon	20.03±1.68	0.63	NS
Secure	17.05±1.05		



DISCUSSION

Dental adhesives proved to be efficient and successful adjuncts to denture treatments for retention, stability and function of the complete dentures. They increase the efficiency by providing sufficient retention, confidence, comfort and psychological satisfaction to the patients, especially the new denture wearers during the adaptation period. The use of dental adhesive began in the 18 century.¹⁰ In the recent past pharmacists used to prepare denture adhesives by mixing plant gums to produce a material which absorbs the humidity of the saliva and swell to form a thick mucilaginous layer adhering to the oral mucosa and dentures. Adhesives have gained much popularity and importance due to the increase demand owing to the increased geriatric population. Nevertheless, removable complete dentures still presents one of the most important treatment options in prosthodontics. Combination of both physical and chemical properties of denture adhesives helps the denture staying in

place, preventing their movement during chewing or speech. The viscosity of the adhesive is increased by saliva, which sequentially increases the forces required to separate the denture from the underlying tissue surface. Commercially available newer adhesive materials are efficient in providing stronger cohesive and bio-adhesive forces. These adhesives provide increased viscosity which results in lateral spread excluding the air and saliva thus increasing the retention and stability of the denture.¹¹ Thus, adequate retention and stability becomes the main prerequisite in the success of complete denture therapy. Therefore, improving these two properties become a considerable part in prosthodontics. Literature regarding the side effects of denture adhesives has been advocated specifically related to the toxic effect of zinc formulated denture adhesive causing myleoneuropathy and hypocuperima.¹² Thus, various attempts have been made to solve the problem of retention without any side effect and compare their

efficacy to recommend the best denture adhesive available.

The main of our study was to compare and evaluate the efficacy of four different commercially available denture adhesive namely FITTYDENT, FIXON, ISBAGOL, AND SECURE cream on the resorbed ridges of the order 5. The results of the study showed that the use of denture adhesives were not only beneficial in providing retention but also increasing the acceptance level among the denture wearers. The study was in accordance with the study conducted by **Fujimori et al** where he found that the use of denture adhesives improved maximum biting force and provided increased rhythmic masseteric muscle activity during mastication.¹³ In another study conducted by **Abdulla and Khamas** in 2009, observed a significant improvement in the mandibular complete denture retention with flat ridges when used with three different denture adhesive.¹⁴ **Kulak et al** in 2005, observed similar results where he found higher satisfaction with the retention of denture using denture adhesive especially in mandibular ridges.¹⁵

The results of our study exhibited that Fittydent was the most effective denture adhesive among the entire four compared adhesive. A highly statistically significant improvement in mean retention was observed in Fittydent followed by Isbagol, Secure and then Fixon. Secure and Fixon had statistically insignificant results when compared to each other. The results of our study were in consistent with study conducted by **Malhotra et al** where they obtained highly statistically significant results with that of fittydent denture adhesive when compared with isbagol and fixon.¹⁶

Chowdhry et al in 2010 conducted an invitro study where they examined the retention ability of different commercially available adhesive materials. They concluded that the products which were delivered as pastes were found to be more resistance to dislodgement than the powder forms.¹⁷ In another study conducted by **Jian-Min Han et al**, measured the adhesive strength and initial viscosities of 3 powder type and 3 cream based denture adhesives which were commercially available. They also concluded that the cream type denture adhesive was lower than the powder, but which significantly increased when immersed in water.¹⁸

Thus, the results of our study concluded that highly significant results were found using fittydent which is highest among the all with somewhat equal in efficacy with that of isbagol. Fixon and secure, although effective in providing retention but had less significant and non significant values when compared. Variation of our results can be due to the unknown apparatus error, study design and or due to the different brands of the adhesives. It can be concluded that a denture adhesive can be suggested to the patient with resorbed ridges to increase the retention and stability of the same. However the patient must be aware and warned about the various formulation, use

and misuse and application instruction of the denture adhesive.

CONCLUSION

Within the limitation of this study it can be concluded that all the denture adhesives used in the study exhibited significantly higher retentive abilities. Higher significant improvements were observed with the used of denture adhesive of the order **FITTYDENT ≥ ISBAGOL > SECURE > FIXON**.

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