



ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2021; 7(2): 583-589
© 2021 IJADS
www.oraljournal.com
Received: 22-02-2021
Accepted: 24-03-2021

Dr. Nidhi Duggal
Associate Professor &
Head, Department of
Prosthodontics, Government
Dental College & Hospital
Patiala, Punjab, India

Dr. Sarabjit Kaur
Associate Professor, Department
of Prosthodontics, Government
Dental College & Hospital
Patiala, Punjab, India.

Dr. Rajinder Kumar
Post Graduate Student,
Department of Prosthodontics,
Government Dental College &
Hospital Patiala, Punjab, India.

Dr. Honey Chandel
Post Graduate Student,
Department of Prosthodontics,
Government Dental College &
Hospital Patiala, Punjab, India

Dr. Lokendra Singh
Post Graduate Student,
Department of Prosthodontics,
Government Dental College &
Hospital Patiala, Punjab, India.

Dr. Rupali Modi
Post Graduate Student,
Department of Prosthodontics,
Government Dental College &
Hospital Patiala, Punjab, India.

Corresponding Author:
Dr. Nidhi Duggal
Associate Professor &
Head, Department of
Prosthodontics, Government
Dental College & Hospital
Patiala, Punjab, India

An *in-vivo* study to evaluate and compare the effect of three different zinc free denture adhesives on retention of mandibular complete dentures after different adaptation periods

Dr. Nidhi Duggal, Dr. Sarabjit Kaur, Dr. Rajinder Kumar, Dr. Honey Chandel, Dr. Lokendra Singh and Dr. Rupali Modi

DOI: <https://doi.org/10.22271/oral.2021.v7.i2i.1268>

Abstract

Retention in mandibular dentures has always been a challenge for the Prosthodontist and this situation worsens in patients with resorbed ridges. Denture adhesives are known to improve the adhesive bond between the denture and the underlying tissues. But still biocompatibility issues have been noticed from zinc containing denture adhesives in various studies and they recommended using zinc free denture adhesives. However, zinc free denture adhesives still remain unexplored and not much is known about the efficacy of these materials in mandibular dentures especially in patients with poor foundations. The present study was carried out to compare the efficacy of three different commercially available zinc free denture adhesives in relation to their retentive ability in patients with well formed mandibular ridges and in patients with resorbed mandibular ridges. Thirty edentulous patients were selected and the patients were divided into 2 groups; group A comprised of 15 patients with well formed mandibular ridges and group B consisted of 15 patients having resorbed mandibular ridges. The adhesion and cohesion that developed between the dentures and the underlying tissues with and without denture adhesives was evaluated with the help of a force gauge test apparatus in newtons at three different times of adaptation period. Zinc free denture adhesives significantly improved the retention of mandibular complete dentures not only in case of well-formed residual ridges but also resorbed ridges. Use of zinc free denture adhesive led to a higher value of retention as opposed to when the dentures were used without adhesives at all time intervals of adaptation period. Poligrip adhesive was the most effective among all three adhesives used in the study, while Secure was intermediate and Fixon Supergrip was least effective.

Keywords: zinc free denture adhesives, mandibular resorbed ridges, retention

1. Introduction

Retention, a key factor for the success of complete dentures is influenced by physical, physiological, psychological, mechanical and anatomical factors. It has been observed that retention is difficult to achieve in mandibular dentures because of comparatively less denture bearing area i.e. 12.5 cm² as compare to 22 cm² for maxillary dentures and this situation worsens in patients with resorbed ridges. Other factors which influence the retention of mandibular dentures are size, shape and position of tongue and also the position of floor of the mouth. Sometimes irrespective of psychological, occupational, morphological and functional reasons, patients are not satisfied with retention and stability of dentures. To improve the retention and stability of complete dentures, there have been significant advances in recent years, such as implant supported dentures, denture soft liners, and overdentures. However, most edentulous patients cannot be provided with implant supported prostheses due to their systemic conditions and/ or financial constraints. In such cases, denture adhesives are advocated as an inexpensive and easy alternative option. Denture adhesive enhance retention through optimizing interfacial forces by increasing the adhesive and cohesive properties and viscosity of the medium lying between the denture and basal seat, and eliminating the voids between the denture base and its basal seat. Earlier denture adhesive used were based on

vegetable gums (e.g. Karaya, Xanthan and Acacia). Later synthetic adhesives consisting of mixtures of salts of short acting and long acting polymers were introduced. Various denture adhesives are available as creams, powders, gels, strips, and wafers according to their formulation.

An ideal denture adhesive should be safe and biocompatible. But still biocompatibility issues have been noticed. Gelfand (1949) ^[1] reported allergic reactions to Karaya vegetable gums and Paraben preservatives. Nations *et al.* (2008) ^[7] and Hedera *et al.* (2009) ^[3] analyzed unexplained hyperzincemia and copper deficiency and reported denture adhesives to be the possible source of high content of zinc. Mutluay, Carvalho and Pashley (2010) ^[6] documented the adverse effects of zinc from denture adhesives and recommended zinc free denture adhesives. Grasso, Rendell and Gay (1994) ^[2] and Manes *et al.* (2010) ^[4] observed significant increase in retention and stability of maxillary dentures with the use of denture adhesives. Munoz *et al.* (2011) concluded that denture adhesives are indicated only in well fabricated and well fitting dentures for improving retention, stability and satisfaction, and not indicated in improperly fabricated or poorly fitting dentures.

In literature, various studies are available regarding the effect of denture adhesives on the retention of complete dentures; However, the effect of zinc free denture adhesives on retention of mandibular dentures has remained relatively unexplored. Hence, the study was planned to evaluate and compare the effect of three different types of zinc free denture adhesives on the retention of mandibular complete dentures in well-formed and resorbed ridges after different adaptation periods.

Materials and methods

The study was conducted on thirty completely edentulous subjects, who reported in the out-patient department of Prosthodontics at Govt. Dental College and Hospital, Patiala for the fabrication of complete dentures. Patients were divided into two groups of fifteen each, group 'A' patients with well-formed mandibular ridges and group 'B' patients with resorbed mandibular ridges. The study was approved by the ethical committee of the institution. After informing the study procedure to subjects, a voluntary informed consent was obtained and each patient was provided with new set of complete dentures fabricated by conventional method.

On the day of denture insertion, dentures were checked and needed adjustments were performed accordingly till patient's satisfaction. After that the mandibular denture was prepared for the study. Just behind and between the mandibular central incisors, a hook of about 2inch length was secured with autopolymerizing resin. This was done in order to apply force in the midline via the test apparatus. The retention of mandibular complete denture was recorded in terms of the force required to dislodge the denture from ridge using a digital force gauge (model: FG-5000A, Lutron Electronics, graduated upto 5000gm). A special apparatus was designed so that subject's head and the chin could be made stationary and the amount of jaw opening could be repeated in successive test and to engage the digital force gauge device.

Recording the retention of mandibular denture without denture adhesive

For testing, the patient was seated comfortably in an upright position and the chin was placed quite firmly in chin rest of the specially designed apparatus with the forehead leaning solidly against the forehead rest. Maxillary and mandibular

dentures were inserted in patient's mouth and patient was guided to close in centric occlusion and asked to hold the position for 2 minutes. Than after the calibration of the device, the patient was asked to open his/her mouth to a sufficiently comfortable distance and hook of the dislodging rod of the apparatus was engaged in the hook attached to the mandibular complete denture.

The digital force gauge device was activated and force was applied steadily until the denture got completely dislodged from the underlying ridge. The force value at which the denture was dislodged was recorded as the retention force of the denture. A controlled experimental procedure was followed; three consecutive readings were recorded and mean dislodging force was calculated.

Recording the retention of mandibular denture with denture adhesive

Retention of mandibular denture was measured after application of three zinc free denture adhesives –Poligrip, Secure, FixonSupergrip

The adhesive cream was applied on mandibular dentures according to manufacturer's instructions. The patient was instructed to rinse mouth before insertion of dentures. The maxillary denture was inserted first, then mandibular denture washed, cleaned and tissue surface was dried. Denture adhesive was applied in three short strips one in anterior and two on posterior region but not too close to the denture edges. The mandibular denture was inserted and seated with slight pressure and the patient was asked to bite down for a few seconds to secure hold. For recording the denture retention, same procedure was followed as done for without adhesive. After recording the retention value for one denture adhesive, same procedure was repeated for the other two denture adhesives. The denture was cleaned very carefully after each experiment with clinsodent solution. Denture was thoroughly rinsed with water and a soft brush was used to remove all traces of the previous adhesive material and then dried, so that the procedure would be free of any effects of previous adhesive between the experiments. The same procedure was carried out for both groups at three different time intervals:-

1. Immediately after denture insertion
2. One month after denture insertion
3. Three months after denture insertion

Readings were recorded and the collected data was tabulated to evaluate and compare the retention of mandibular complete dentures in both groups with and without three different zinc free denture adhesives. The data thus collected was subjected to statistical analysis.



Fig 1: Metal hook secured with autopolymerizing resin just behind and between the central incisors



Fig 2: Zinc Free Denture Adhesives- Poligrip, Secure & Fixonsupergri



Fig 3: Recording The Retention Value On Force Gauge Device By Applied The Force Until The Denture Dislodgement

Results

Fig 1: Comparison of mean retention values of mandibular dentures for both groups i.e. Resorbed ridges and well formed ridges with and without denture adhesives immediately after insertion

Retention	Groups	Mean	Standard deviation	p-value	Significance
without adhesive	Resorbed ridges	5.404	1.226	<0.001	HS
	Well formed ridges	14.96	1.201		
With adhesive (Poligrip)	Resorbed ridges	20.72	1.551	<0.001	HS
	Well formed ridges	21.51	1.556		
With adhesive (Secure)	Resorbed ridges	12.88	2.018	<0.001	HS
	Well formed ridges	19.07	1.244		
With adhesive (Fixon)	Resorbed ridges	12.11	1.640	<0.001	HS
	Well formed ridges	18.32	0.758		

Fig 2: Comparison of mean retention values of mandibular dentures for both groups i.e. Resorbed ridges and well formed ridges with and without denture adhesives after one month of insertion

Retention	Groups	mean	Standard deviation	p-value	Significance
without adhesive	Resorbed ridges	6.16	1.127	<0.001	HS
	Well formed ridges	17.49	1.528		
With adhesive (Poligrip)	Resorbed ridges	20.93	1.640	<0.001	HS
	Well formed ridges	23.41	1.677		
With adhesive (Secure)	Resorbed ridges	13.18	1.853	<0.001	HS
	Well formed ridges	20.03	1.332		
With adhesive (Fixon)	Resorbed ridges	12.45	1.558	<0.001	HS
	Well formed ridges	19.68	1.039		

Fig 3: Comparison of mean retention values of mandibular dentures for both groups i.e. Resorbed ridges and well formed ridges with and without denture adhesives after three months insertion

Retention	Groups	Mean	Standard deviation	p-value	Significance
without adhesive	Resorbed ridges	8.21	1.087	<0.001	HS
	Well formed ridges	20.88	1.864		
With adhesive (Poligrip)	Resorbed ridges	21.70	1.357	<0.001	HS
	Well formed ridges	25.89	1.730		
With adhesive (Secure)	Resorbed ridges	15.33	1.617	<0.001	HS
	Well formed ridges	22.91	1.905		
With adhesive (Fixon)	Resorbed ridges	15.03	1.649	<0.001	HS
	Well formed ridges	22.48	1.802		

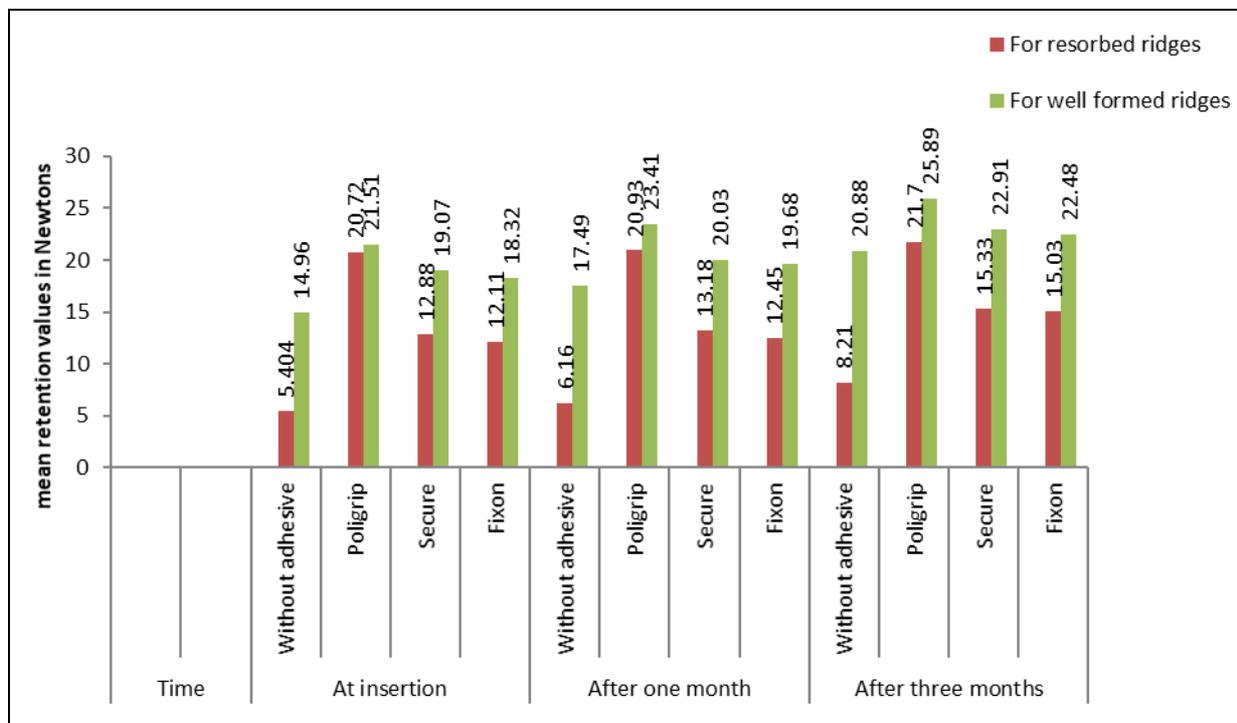


Fig 4: Comparison of mean retention values of mandibular dentures for resorbed ridges and well formed ridges with and without denture adhesives at different time intervals

Table 4: Comparison of mean retention values of mandibular dentures for well-formed ridges with use of Poligrip, Secure and Fixon denture adhesives immediately after insertion

Groups	Mean	S.D	P value	Significance
Poligrip	21.51	1.556	<0.001	HS
Secure	19.07	1.243		
Poligrip	21.51	1.556	<0.001	HS
Fixon	18.32	0.758		
Secure	19.07	1.243	0.101	NS
Fixon	18.32	0.758		

Table 5: Comparison of mean retention values of mandibular dentures for resorbed ridges with use of Poligrip, Secure and Fixon denture adhesives immediately after insertion

Groups	Mean	S.D	P value	Significance
Poligrip	20.72	1.551	<0.001	HS
Secure	12.88	2.018		
Poligrip	20.72	1.551	<0.001	HS
Fixon	12.11	1.640		
Secure	12.88	2.018	0.236	NS
Fixon	12.11	1.640		

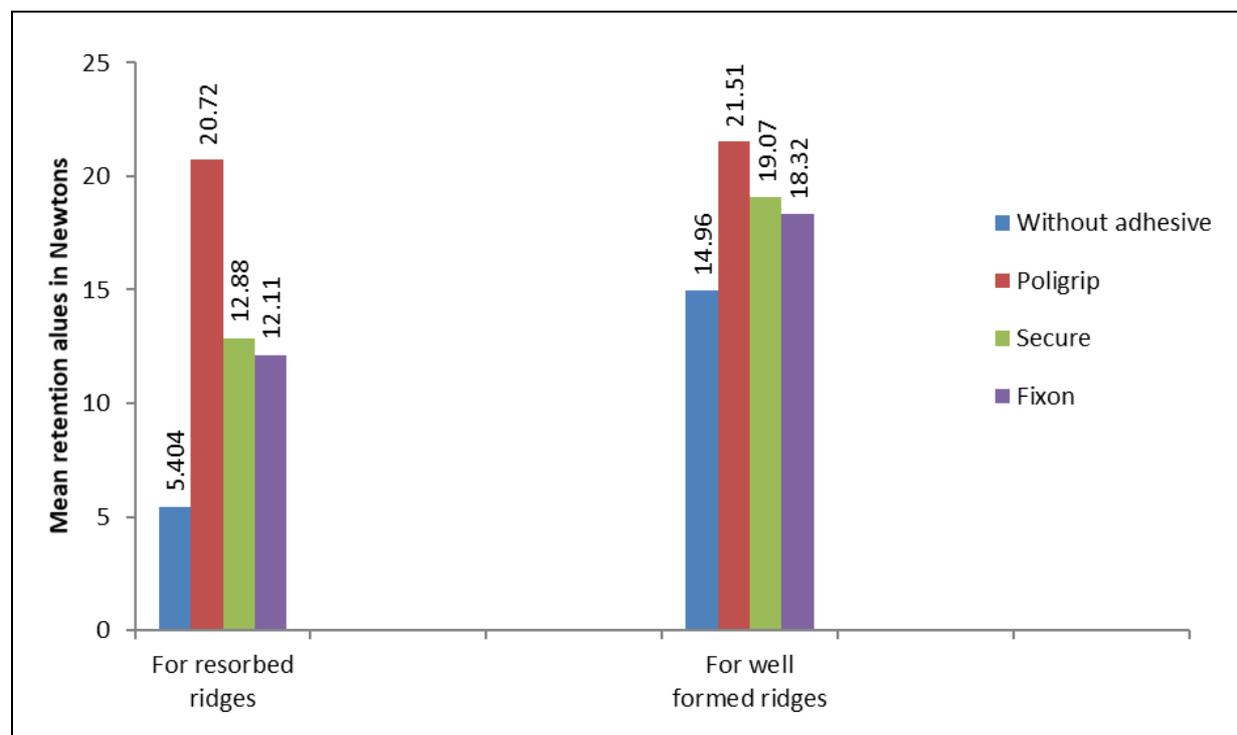


Fig 5: Comparison of mean retention values of mandibular dentures for resorbed ridges and well formed ridges with and without denture adhesives after one month of insertion

Table 6: Comparison of mean retention values of mandibular dentures for well-formed ridges with use of Poligrip, Secure and Fixon denture adhesives after one month of insertion

Groups	Mean	S.D	P value	Significance
Poligrip	23.41	1.677	<0.001	HS
Secure	20.03	1.332		
Poligrip	23.41	1.677	<0.001	HS
Fixon	19.68	1.039		
Secure	20.03	1.332	0.492	NS
Fixon	19.68	1.039		

Table 7: Comparison of mean retention values of mandibular dentures for resorbed ridges with use of Poligrip, Secure and Fixon denture adhesives after one month of insertion

Groups	Mean	S.D	P value	Significance
Poligrip	20.93	1.640	<0.001	HS
Secure	13.18	1.853		
Poligrip	20.93	1.640	<0.001	HS
Fixon	12.45	1.558		
Secure	13.18	1.853	0.242	NS
Fixon	12.45	1.558		

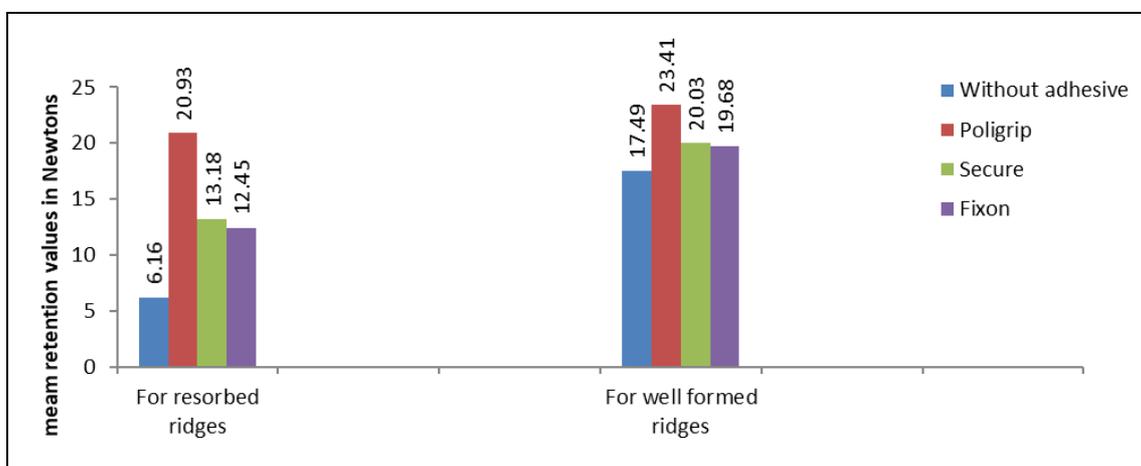


Fig 6: Comparison of mean retention values of mandibular dentures for resorbed ridges and well formed ridges with and without denture adhesives after three months of insertion

Table 8: Comparison of mean retention values of mandibular dentures for well-formed ridges with use of Poligrip, Secure and Fixon denture adhesives after three months of insertion

Groups	mean	S.D	P value	Significance
Poligrip	25.89	1.730	<0.001	HS
Secure	22.91	1.905		
Poligrip	25.89	1.730	<0.001	HS
Fixon	22.48	1.802		
Secure	22.91	1.905	0.523	NS
Fixon	22.48	1.802		

Table 9: Comparison of mean retention values of mandibular dentures for resorbed ridges with use of Poligrip, Secure and Fixon denture adhesives after three months of insertion

Groups	Mean	S.D	P value	Significance
Poligrip	21.70	1.357	<0.001	HS
Secure	15.33	1.617		
Poligrip	21.70	1.357	<0.001	HS
Fixon	15.03	1.649		
Secure	15.33	1.617	0.588	NS
Fixon	15.03	1.649		

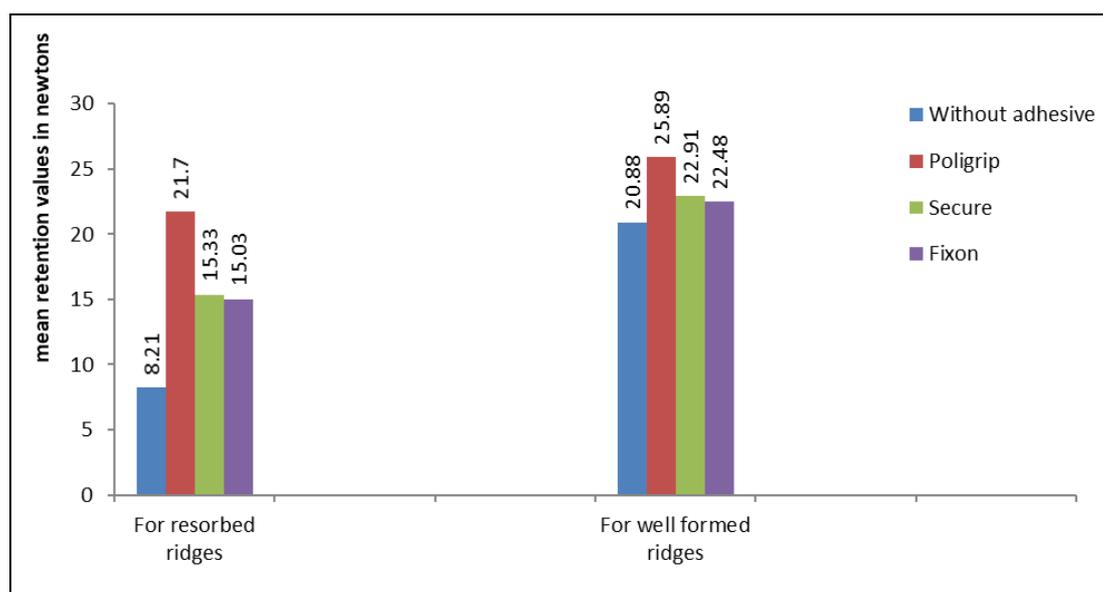


Fig 7: Comparison of mean retention values of mandibular dentures for resorbed ridges and well formed ridges with and without denture adhesives after three months of insertion

Discussion

Denture adhesives were introduced as an adjunct to denture treatment to improve retention and function of complete

dentures. Denture adhesives increase the efficiency of the dentures and provide sufficient retention, comfort, confidence and also psychological satisfaction to the patients, especially

in new denture wearers during adaptation period. Denture adhesives are commercially available non-toxic materials, which increase the retention of complete dentures by increasing the adhesion between tissue surface of denture and underlying mucosal tissues. Initially, the composition of denture adhesives was a mixture of vegetable gums. The composition of denture adhesives continues to change since then; as the manufacturers try to improve the effectiveness of their products by adding calcium salts and zinc in formulation of denture adhesives. Nowadays, synthetic polymers like carboxymethyl cellulose (CMC) and polyvinyl methyl ether mallet anhydrate (PVM/MA) are being used in denture adhesives as main adhesive agents. A lot of literature regarding the various side effects of denture adhesives has been advocated particularly related to toxic effects of zinc containing denture adhesives in complete denture patients causing hypocuperima and myleoneuropathy as documented by Nations S.P. *et al.* (2008) [7], Mutuluay A.T. *et al.* (2010) [6] and V.D. Singh *et al.* (2015). In the recent years, most of the researchers are of the opinion that zinc free denture adhesives should be prescribed to complete denture patients and that too only if adhesive is required. But not much literature regarding the efficiency of zinc free denture adhesive is available in terms of their effect on retention of complete dentures. Hence three commonly available zinc free denture adhesives namely POLIGRIP, SECURE and FIXON SUPERGRIP were used in the present study. It was conducted on thirty completely edentulous patients to compare the effect of three different zinc free denture adhesives on retention of mandibular complete dentures for well-formed ridges (group A) and resorbed ridges (group B) for edentulous patients at different adaptation periods i.e. immediately after insertion, after one month of insertion and after three months of insertion. The reason for choosing these adaptation periods was that most of the changes in supporting structures occur during the first 4 weeks after insertion of new prosthesis and adaptation period of 90 days has been considered adequate for new prosthesis (Polyzois *et al.* 2013) [9]. The adaptation of new dentures depends upon the growth of muscles and supporting structures involved during function and masticatory process. The psychological adaptation of patients for new prosthesis is as important as with supporting structures with new prosthesis. Some patients may find it difficult to adapt to a new prosthesis psychologically and may need some extra adhesion and fit for their new prosthesis especially during the first few weeks of adaptation. Denture adhesives can provide that extra adhesion and fit to new prosthesis during this crucial period of adjustment.

The results of the present study showed that the use of the zinc free denture adhesives not only improved retention in patients with well formed ridges but patient with resorbed mandibular ridges were also benefitted at all three intervals of adaptation period. These observations can be correlated with the study of Kulak Y. *et al.* (2005) who observed that satisfaction with the retention of mandibular dentures was higher with the use of denture adhesives. But the satisfaction rate for retention was still less for mandibular dentures when compared with maxillary dentures. They gave the possible explanation for this finding that not only the denture adhesive itself, but also the heights of the existing ridges played a role in the satisfaction with retention of dentures as maxillary dentures occupy larger space and often the ridges were less resorbed than mandibular ridges.

Abdulla and Khamas (2009) recorded a significant improvement in retention of mandibular complete dentures

for flat ridges after using three types of denture adhesives. The results of present study also exhibited that Poligrip was the most effective denture adhesive among all three tested denture adhesives. A highly significant improvement in difference of mean retention with Poligrip adhesive was recorded in both groups at all time intervals of adaptation period followed by Secure and Fixonsupergrip. Secure and Fixonsupergrip had statistically non-significant difference when compared to each other at all time intervals of adaptation period for both groups. These findings were consistent with those of Munoz C.A. *et al.* (2011) who concluded that Poligrip denture adhesives increased retention and stability of well-fitting and well-made dentures and also that a single application of denture adhesives increased comfort, confidence and satisfaction with dentures in conjunction with chewing hard and brittle food. The strength and viscosity are the most important properties of denture adhesives. The composition of denture adhesive has a significant effect on initial viscosity and adhesive strength. The main component of Poligrip are both PVM/MA and cellulose gum which may have been responsible for making it the most effective among all zinc free adhesive evaluated in this study and in case of Secure, the active ingredient is only CMC; and Fixonsupergrip, the cellulose gum. As explained by Jian m. *et al.* 2013 that denture adhesives containing PVM/MA were more effective than denture adhesives containing CMC. CMC starts its action immediately on coming in contact with saliva and a hydrate material is formed, but it loses its adhesiveness immediately by dissolving in saliva or water, while PVM/MA dissolve slowly in saliva or water and maintains its adhesiveness for longer time.

The statistical variation between the patients for all the measurements of retention might be due to the differences in residual alveolar ridge dimensions and structure such as ridge height, surface area and also the seating force applied. During recording the retention, the main limiting factor was patient's saliva. There was no control over the amount and consistency of saliva which had the potential to change between measurements. Another limiting factor was the patient's tongue position. A concerted effort was made to make sure that the tongue was always in same position. However, it was difficult to ascertain whether or not the tongue was in the same position for each measurement.

Conclusions

Within the limitations of the study, the results exhibit that the zinc free denture adhesives have the ability to improve the retention of mandibular complete dentures in patients with well-formed ridges as well as resorbed ridges. Poligrip was found to be the most effective zinc free denture adhesive followed by Secure and Fixon Supergrip. The zinc free denture adhesives are safer to use than zinc containing adhesives, but should only be prescribed by the dentist when indicated. Patients should be guided about the method of use, frequency and quantity to apply on complete dentures and warned about the misuse of denture adhesives as these adhesives should not be used with ill-fitting dentures and broken prostheses. Adaptation period does affect the retention of mandibular complete dentures for well-formed ridges and resorbed ridges as retention improved with adaptation of dentures. The results of this study suggest that the application of zinc free denture adhesives can be recommended to improve the retention of mandibular complete dentures, particularly for patients with resorbed alveolar ridges during

the initial adaptation periods.

References

1. Gelfand H. 'The vegetable gums by ingestion in the etiology of allergic disorder', *Journal of Allergy*, 1949;20(5):311-321.
2. Grasso JE, Rendell J, Gay T. 'Effect of denture adhesives on the retention and stability of maxillary dentures', *J Prosthet Dent* 1994;72(4):399-405.
3. Hedera P, Peltier A, Fink JK, Wilcock S, London Z, Brewer GJ. 'Myeloneuropathy and pancytopenia due to copper deficiency and high zinc levels of unknown origin II. The denture cream is a primary source of excessive zinc', *Neurotoxicology* 2009;30:399-405.
4. Manes JF, Selva EJ, Barutell AD, Bouazza K. 'Comparison of the retention strengths of three complete denture adhesives: An *in vivo* study', *Med oral patol oral cirbucal*, 2010;1:e132-136.
5. Munoz CA, Gendreau L, Shanga G, Magnuszewski T, Fernandez P, Durocher J. 'A clinical study to evaluate denture adhesive use in well fitting dentures', *Journal of Prosthodontics* 2012;21:123-129.
6. Mutluay AT, Carvalho RM, Pashley DH. 'Hyperzincemia from ingestion of denture adhesives', *J Prosthet Dent* 2010;103(6):380-383.
7. Nations SP, Boyer PJ, Love LA, Burritt MF, Butz JA, Wolfie GI *et al.* 'Denture cream: An unusual source of excess zinc, leading to hypocupremia and neurologic disease', *Neurology* 2008;71:639-643.
8. 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):578-585.
9. Polyzois G, Partalis C, Lagouvardos P, Polyzois H. 'Effect of adaptation time on the occlusal force at denture dislodgement with or without denture adhesive', *J Prosthet Dent* 2014;111(3):216-221.
10. Salman YM, Ibrahim IK. 'Effect of denture adhesives on the retention of maxillary complete denture', *J Coll Dentistry* 2005;17(1):30-34.