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A comparative study of patients satisfaction with conventional and relined mandibular complete dentures

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Abstract

Edentulous patients are usually satisfied with the service of a conventional maxillary denture but not the mandibular denture, particularly if the patients present with advanced atrophy of residual ridges, systemic diseases, chronic tissue soreness or maladaptive denture wearing experience. For such patients, the relining of hard heat cured mandibular dentures with long term resilient denture liners may be considered as a non-surgical alternative to pre-prosthetic procedures or implant supported prostheses.

Purpose of The Study: The purpose of the study was to compare the satisfaction level of the patients provided with both conventional and relined mandibular dentures.

Materials and Methods: The study was conducted on fifteen edentulous patients. Each patient was provided with one maxillary and two mandibular complete dentures i.e. one conventional and another relined with long term silicone-based resilient liner (Molloplast-B). Patients' general satisfaction with the two mandibular dentures was evaluated using questionnaire. The data so collected was compared and analyzed statistically.

Results: The overall analysis of the results obtained from the study suggested that the use of soft liners may promote a more satisfying life for edentulous patients. There was an improvement in patients' general satisfaction rating, ability to chew & speak, fit and comfort with relined mandibular dentures as compared to conventional acrylic resin mandibular dentures opposed by conventional maxillary dentures and the majority of patients had a preference for the relined mandibular dentures.

Keywords: patients' satisfaction, relined mandibular, dentures

Introduction

Resilient denture liners, also known as soft liners, are indicated for relining of hard acrylic resin complete dentures for edentulous patients having thin and non-resilient oral mucosa, sharp or resorbed alveolar ridges, chronic tissue soreness or persistent pain under the conventional dentures and immediate dentures or dentures exhibiting poor retention. This treatment modality has been particularly advocated for the patients who cannot be rehabilitated with implant supported prosthesis due to medical conditions, financial constraints or inadequate bone quality and quantity.

The application of soft denture liners has been reported to increase the comfort of denture wearers and support the prosthetic treatment as these evenly distribute and absorb the masticatory forces by their cushioning effect. These also maintain an intimate contact with the underlying tissues, thereby providing better retention and stability of dentures during function, mastication and rest.

Based on their duration of use, resilient liners are broadly classified into short term or temporary denture liners to be used for a few days to weeks and long term or permanent soft liners for a period of one year. The soft liners which can be used for up to 6 months have been called as intermediate liners by certain authors. Long term soft liners are further categorized into five groups based on their chemical structure as plasticized acrylics, plasticized vinyl polymers, polyurethane, polyphosphazene and silicone rubbers. Of these, silicones and plasticized acrylics are the most popular contemporary soft liners which are available in

soft liners which are available in chemical or heat activated forms.

As compared to the short term soft reliners, the long term denture reliners possess better hardness, durability and low water sorption and solubility. The acrylic permanent soft liners demonstrate better visco-elastic behaviour and improved masticatory function than the silicone permanent soft liners but are more prone to dimensional changes and surface deterioration due to leaching of the plasticizers over time. The silicone long term soft liners are preferred due to their more durability and longevity.

Various clinical studies e.g. Crum *et al* (1971) [3], Kismoto *et al* (2014) [10] and Mangtani N *et al* (2015) [13] suggested that the application of resilient liner to the mandibular denture improves the retention, stability and masticatory efficiency of the prostheses and the general satisfaction of the patients. Chaldek G *et al* (2014) [2] also advocated the use of long term soft denture lining material to decrease the trauma associated with the conventional dentures and to increase the comfort of patients. Mangtani N *et al* (2015) [13] concluded that the mandibular dentures lined with acrylic soft liners provided better masticatory efficiency but the general satisfaction of patients was similar to that of conventional dentures

The literature reveals that various studies have been undertaken to evaluate the effect of resilient soft liners, applied to mandibular complete dentures, on satisfaction rating, masticatory efficiency and ridge resorption in complete denture wearers. These exhibited both favourable and unfavourable clinical results with the soft liners. Also, there appears to be a lack of comparative intraindividual studies regarding patients' satisfaction with conventional and relined dentures.

Therefore, a study was conducted to compare the satisfaction level of completely edentulous patients provided with both the conventional and resilient mandibular dentures opposed by conventional maxillary dentures and also to gain more clinically relevant information about patients' experience with relined mandibular dentures.

Materials and Methods

After approval of the institution's ethical committee, the study was conducted on fifteen edentulous patients, who reported in the outpatient department of Prosthodontics at Govt Dental College and Hospital, Patiala for fabrication of complete dentures.

Patients with good general and oral health, well healed ridges with firm mucosa and adequate inter-ridge space in class I relationship were selected for the study. Patients suffering from neuromuscular disorder or any systemic disease that influenced bone metabolism and those lacking understanding to reading and respond to a written questionnaire were excluded from the study. Voluntary written informed consent was obtained from the participants in the study.

For each patient, one maxillary complete denture and two sets of mandibular complete dentures were fabricated. One maxillary and mandibular complete dentures were constructed using the conventional technique and the second mandibular denture was made using a permanent heat-cured silicone soft reliner i.e. Molloplast-B.

For construction of complete dentures, maxillary and mandibular preliminary impressions with impression compound in suitable sized stock trays and secondary

impressions with zinc-oxide eugenol impression paste in border moulded acrylic resin custom trays were made. These final impressions were poured in dental stone to obtain the master casts. The mandibular master cast was duplicated in duplicating silicone. After fabrication of wax- occlusal rims on self cured acrylic resin record bases, jaw relationships were recorded and the master casts were mounted on the arcon semi-adjustable articulator using split cast method.

The anatomic acrylic resin teeth were arranged in bilateral balanced occlusion. After try-in, a silicone mold was made of the mandibular waxed denture. By placing identical artificial teeth and pouring molten wax into the silicone mold, an identical mandibular waxed denture on the duplicate mandibular cast was obtained. These were mounted at the same vertical dimension and centric relation on the same articulator. This resulted in one maxillary waxed denture that occluded with two identical mandibular waxed dentures.

The maxillary denture and one of the mandibular denture were processed in heat-cured acrylic resin employing the conventional compression moulding technique.

For fabrication of relined mandibular denture, the space for soft reliner in the mandibular denture was provided by adapting a uniform thickness of 2mm of vacuum formed sheet on the duplicate mandibular cast. Before packing of heat-cured acrylic resin dough into the mold, the cellophane sheet was packed between the resin and the spacer. After trial closure, the spacer and the cellophane sheet were removed and the permanent heat-cured silicone soft relining material i.e. Molloplast-B was packed against the heat-cured acrylic resin dough and the relined denture was processed. After finishing, the dentures were remounted on the articulator to remove any occlusal discrepancies and then polished. The patients were given post-insertion instructions during delivery of the dentures.

Patients' satisfaction with the conventional and relined mandibular dentures was assessed using a questionnaire and was compared and analyzed statistically.



PHOTOGRAPH: DUPLICATING SILICONE MATERIAL, MOLLOPLAST B



PHOTOGRAPH : PACKING OF MOLLOPLAST B AFTER REMOVAL OF VACCUM FORMED SHEET AGAINST HEAT CURED ACRYLIC RESIN



PHOTOGRAPH: INTAGLIO VIEW OF MAXILLARY AND MANDIBULAR CONVENTIONAL COMPLETE DENTURES AND RELINED MANDIBULAR COMPLETE DENTURES

Observations and Results

The patients’ overall satisfaction was assessed using questionnaire in terms of patients’ general satisfaction, appearance, ability to chew & speak, fit and comfort of maxillary and mandibular dentures and other people’s likeness towards patients’ dentures. The data so obtained was compared and analyzed statistically by dividing into four

parameters i.e. fully satisfied (30-36); satisfied (23-29); not-satisfied (16-22) and dissatisfied (9-15) according to scores obtained. It was presented in forms of tables and bar diagrams. Chi-square test was applied to compare the patients’ satisfaction level with conventional and relined mandibular complete dentures opposing conventional maxillary dentures.

Table 1: Comparison of the Patients’ Overall Satisfaction with Conventional Complete Dentures & Maxillary Conventional and Mandibular Relined Dentures

Patients’ overall satisfaction level	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	10	66.7	12	80	22	73.3
Satisfied	5	33.3	3	20	8	26.7
Not satisfied						
Dis-satisfied						
Total	15	100	15	100	30	100
Chi Square	0.682					
P value	0.409					
Df	1					
Significance	NS					

Table 2: Comparison of the Patients’ General Satisfaction Level with Conventional Complete Dentures & Maxillary Conventional and Mandibular Relined Dentures

Patients’ general satisfaction level	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	5	33.3	11	73.3	19	63.3
Satisfied	10	66.7	4	26.7	11	36.7
Not satisfied						
Dis-satisfied						
Total	15	100.0	15	100.0	30	100.0
Chi Square	4.821					
P value	0.028					
Df	1					
Significance	S					

Table 3: Comparison of the Patients’ Satisfaction with Their Appearance with Conventional Complete Dentures & Maxillary Conventional and Mandibular Relined Dentures

Patients’ satisfaction with Appearance	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	14	93.3	11	73.4	25	83.3
Satisfied	1	6.7	2	13.3	3	10
Not satisfied			2	13.3	2	6.7
Dis-satisfied						
Total	15	100	15	100.0	30	100.0
Chi Square	2.693					
P value	0.260					
Df	2					
Significance	NS					

Table 4: Comparison of the Patients’ Satisfaction with Fit of Maxillary Dentures with Conventional and Relined Mandibular Complete Dentures

Patients’ satisfaction with fit of maxillary dentures	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	12	80	12	80	24	80
Satisfied	3	20	3	20	6	20
Not satisfied						
Dis-satisfied						
Total	15	100.0	15	100.0	30	100.0
Chi Square	-					
P value	-					
Df	-					
Significance	-					

Table 5: Comparison of the Patients' Satisfaction With Regard To Fit of Mandibular Conventional and Relined Dentures Opposing Maxillary Conventional Dentures

Patients' satisfaction with fit of mandibular dentures	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	2	13.3	8	53.3	10	33.3
Satisfied	10	66.7	7	46.7	17	56.7
Not satisfied	3	20			3	10
Dis-satisfied						
Total	15	100.0	15	100.0	30	100.0
Chi Square	7.129					
P value	0.028					
Df	2					
Significance	S					

Table 6: Comparison of the Patients' Satisfaction Regarding Their Ability to Chew with Conventional Complete Dentures & Maxillary Conventional and Mandibular Relined Dentures

Patients' satisfaction with ability to chew	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	3	20	7	46.7	10	33.3
Satisfied	7	46.7	8	53.3	16	53.3
Not satisfied	5	33.3			4	13.4
Dis-satisfied						
Total	15	100	15	100	30	100
Chi Square	6.667					
P value	0.036					
Df	2					
Significance	S					

Table 7: Comparison of the Patients' Satisfaction Regarding Their Ability to Speak with Conventional Complete Dentures & Maxillary Conventional and Mandibular Relined Dentures

Patients' satisfaction regarding ability to speak	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	1	6.67	7	46.7	8	26.7
Satisfied	11	73.3	7	46.7	18	60
Not satisfied	3	20	1	6.6	4	13.3
Dis-satisfied						
Total	15	100	15	100	30	100
Chi Square	6.389					
P value	0.041					
Df	2					
Significance	S					

Table 8: Comparison of the Patients' Satisfaction Regarding Comfort of Maxillary Dentures with Conventional and Relined Mandibular Dentures

Patients' satisfaction regarding comfort with maxillary dentures	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	13	86.7	13	86.7	26	86.7
Satisfied	2	13.3	2	13.3	4	13.3
Not satisfied						
Dis-satisfied						
Total	15	100.0	15	100.0	30	100
Chi Square	-					
P value	-					
Df	-					
Significance	-					

Table 9: Comparison of the Patients’ Satisfaction Regarding Comfort with Conventional and Relined Mandibular Dentures Opposing Maxillary Conventional Dentures

Patients’ Satisfaction regarding comfort with mandibular dentures	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	2	13.3	7	46.7	9	30
Satisfied	8	53.4	8	53.3	18	60
Not satisfied	5	33.3			3	10
Dis-satisfied						
Total	15	100.0	15	100.0	30	100.0
Chi Square	7.778					
P value	0.20					
Df	2					
Significance	S					

Table 10: Comparison of Other Peoples’ Likeness towards Patients’ Conventional Complete Dentures and Relined Mandibular Dentures

Others’ people likeness towards Patients’ denture	Conventional Complete Dentures		Maxillary Conventional and Mandibular Relined Complete Dentures		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Fully satisfied	11	73.3	10	66.6	21	70
Satisfied	4	26.7	4	26.7	8	26.7
Not satisfied			1	6.7	1	3.3
Dis-satisfied						
Total	15	100.0	15	100.0	30	100.0
Chi Square	1.048					
P value	0.592					
Df	2					
Significance	NS					

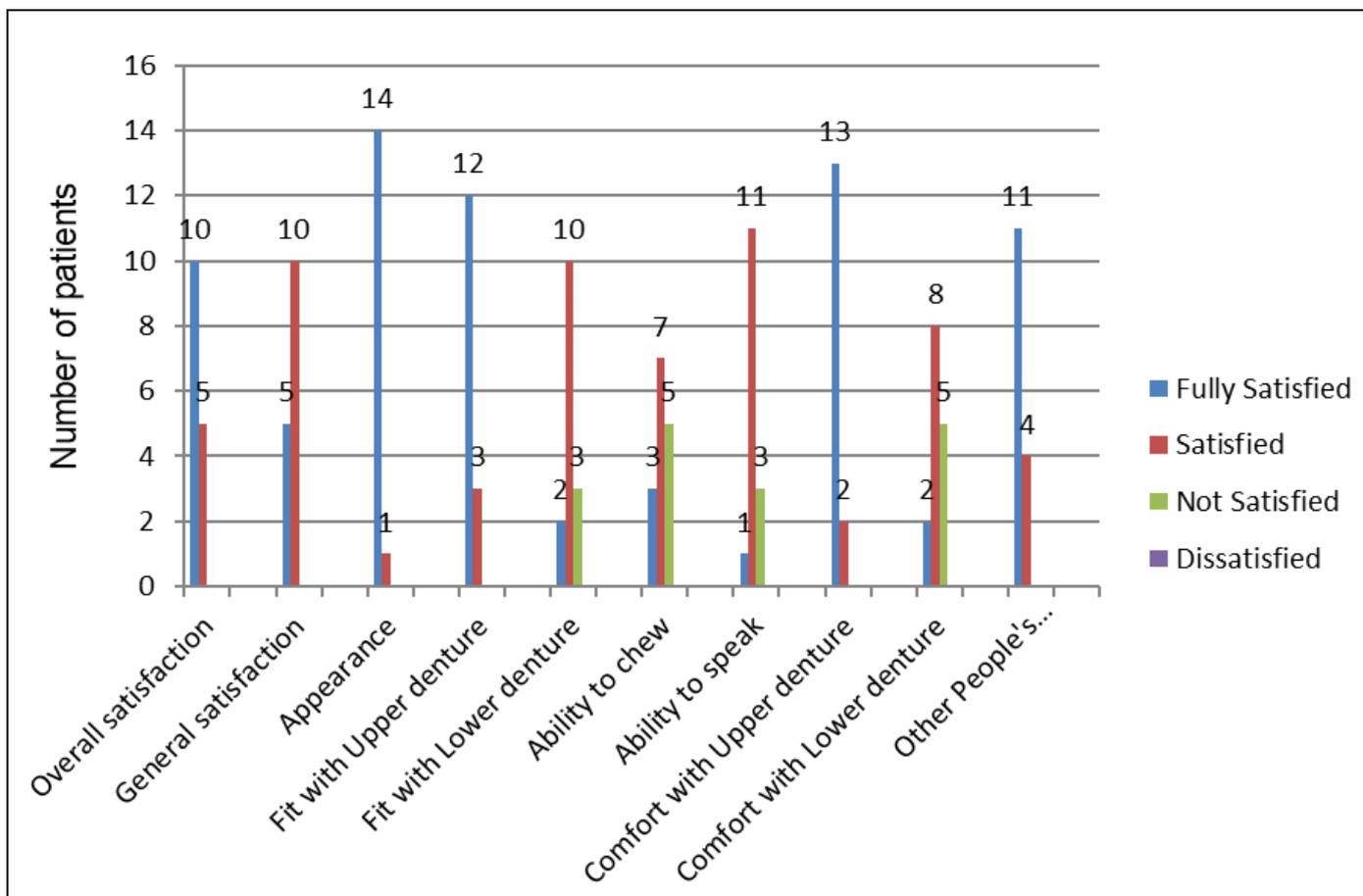


Fig 1: Bar Diagram Showing Number of Patients Satisfied with Upper and Lower Conventional Complete Dentures

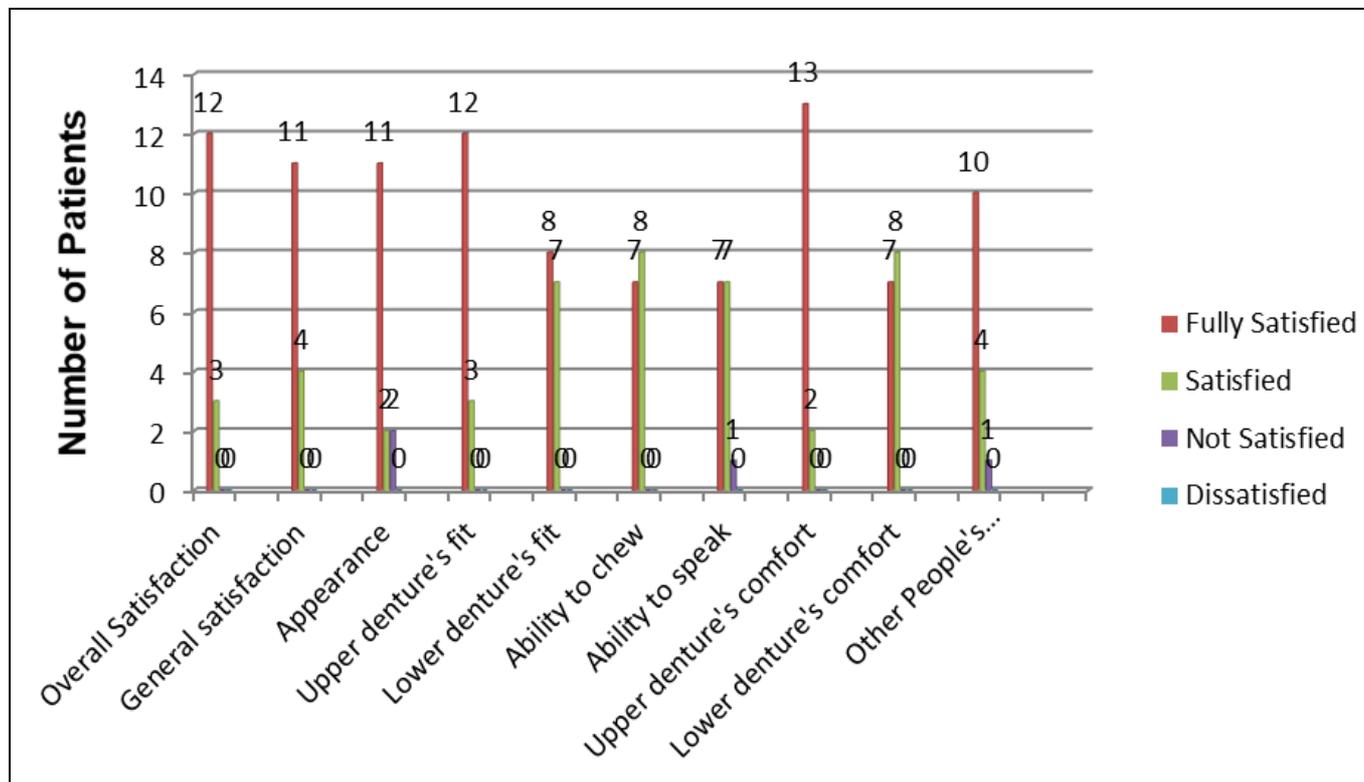


Fig 2: Bar Diagram Showing Number of Patients Satisfied with Upper Conventional and Lower Relined Complete Dentures

Discussion

Conventional complete dentures, consisting of hard non-resilient heat cured acrylic resin material, are unyielding units with no capacity to absorb or dissipate the masticatory or other occlusal forces. Residual alveolar ridges and their supporting mucosa in completely edentulous patients are poor substitutes for the missing periodontal ligament support present in dentate subjects. Furthermore, due to continued ridge resorption, denture bearing area becomes progressively smaller and the overlying mucosa becomes thin, non resilient with little tolerance or adaptability to denture wearing.

Soft liners have been suggested to compensate for the lost thickness and function of mucosa by acting as a cushion between the hard denture base and residual alveolar ridge. Being viscoelastic, these act as shock absorbers and distribute the functional stresses evenly over the entire denture bearing area, thus making it more comfortable for the patients to wear the prostheses.

Molloplast B, a long term heat cured silicone soft liner was selected for relining of mandibular dentures because of its better longevity, more dimensional stability, less water sorption and solubility, higher bond strength and tear strength, decreased surface hardness, long term elasticity, better colour stability and tissue compatibility as compared to acrylic based resilient liners. It was used in thickness of 2 mm which was considered as optimal thickness to provide good cushioning effect and shock absorbability as claimed by previous studies [Yoneyana Y *et al* (2010)] [21].

The results of this study exhibited that relining of mandibular dentures with soft liners improved the patients' satisfaction as compared to the conventional dentures. It was also observed that all the edentulous patients on receiving the dentures were either fully satisfied or satisfied with both the conventional and relined mandibular dentures. However, the patients' overall satisfaction level was greater with relined mandibular dentures as compared to conventional mandibular dentures but the difference was statistically non significant.

As compared to conventional mandibular dentures, there was statistically significant improvement in the patients' general satisfaction rating with relined mandibular dentures. 73.3% patients were fully satisfied with relined mandibular dentures and only 33.3% were fully satisfied with conventional mandibular dentures (Table-2). The enhanced general satisfaction might be due to cushioning and more comfortable effect of soft denture liners. These results were consistent with the studies conducted by Crum *et al* (1971) [3], Kimoto S *et al* (2004, 2014) [10], Pisani MX *et al* (2012) [16].

The comparison of the patients' satisfaction regarding their ability to chew with conventional and relined mandibular dentures was statistically significant. 20% of patients were fully satisfied, 46.7% were satisfied and 33.3% were not satisfied with conventional mandibular dentures whereas 46.7% patients were fully satisfied and 53.3% were satisfied with relined mandibular dentures (Table-6). This implies that the application of the resilient denture liners improved the masticatory function in denture wearers. Kimoto S *et al* (2006) [11] found that there was improvement in masticatory function of complete denture wearers after relining of mandibular dentures with silicone resilient liners resulting in better masticatory function. It might have been due to prolongation of an early occluding phase of masticatory cycle. It was further explained that the reflex controlled by sensory input from the mucosa and the mechanical properties of resilient liners played an important role in prolongation of early occluding phase of masticatory cycle. The reflex might stop the closure of mandible to protect the underlying mucosa from excessive pressure and force. Soft liners being viscoelastic, get deformed and absorb energy and prevent transmission of forces to underlying mucosa. This increased the initial occluding phase of masticatory cycle and more amount of occlusal forces could be applied to chew the food. Murata H *et al* (2008) [14] also reported that viscoelastic properties such as shear storage modulus and loss tangent of soft denture liners led to the most marked improvement in

masticatory function due to extended occluding phase. The findings of present study regarding fit of the dentures exhibited that most of the patients were fully satisfied with fit of their upper dentures irrespective of the type of mandibular dentures. Whereas, the observations regarding patients' satisfaction with fit of their lower dentures showed that more number of patients were fully satisfied (53.3%) and satisfied (46.7%) with fit of their relined mandibular dentures as compared to their conventional mandibular dentures which showed 13.3% were fully satisfied, 66.7% were satisfied and 20% were not satisfied with their lower dentures (Table -5). Lowe, Kydd and Smith had shown that even the well adapted complete dentures on good alveolar ridges move as much as 2.3mm from their original positions during mastication. When a denture moved on its tissue base during function, there was tendency for the border seal to be broken. With the resilient complete dentures, the force of the tongue and buccal musculature acted to mold the denture borders towards the alveolar ridge during function. This maintained the integrity of the border seal and thereby improved the retention of the denture. Waters *et al* (1995) in its study suggested that all the relining materials had greater contact angle hysteresis than polymethylmethacrylate denture base resins and hence improved the stability and retention of denture bases under dislodgement forces.

In the study, with relined mandibular dentures, 46.7% of the patients were fully satisfied in terms of their satisfaction with ability to speak and comfort. With conventional mandibular complete dentures, only 6.67% were fully satisfied with their ability to speak and 13.3% were fully satisfied with their comfort (Tables-7, 9). In general, speaking was influenced by the co-ordination between denture and oral organs such as cheeks, lips and tongue. If complete denture wearers experienced any irritation or pain in their mouth, they would hesitate to speak. It was conceivable that speaking was significantly affected by resilient liners that could influence the comfort by transmitting less stresses to ridges and caused improved satisfaction in relined mandibular dentures than conventional ones.

The patients' satisfaction regarding comfort with their upper dentures was found clinically and statistically same with both the conventional and relined mandibular dentures. It was because other than the type of lower denture, the anatomic and physiologic factors including shape and size of alveolar ridges played a key role in retention, stability and comfort of upper dentures.

With appearance, more patients were satisfied with conventional mandibular dentures as compared to relined mandibular dentures but the difference was statistically non significant (Table-3). Also, some patients complained of discoloration, staining and difficulty in cleaning of their relined mandibular dentures. To overcome these issues, the patients were advised to soak their relined mandibular dentures for fifteen minutes in solution of benzalkonium chloride in 1:750 concentration after brushing with water.

Regarding the 'other people's likeness towards patients' denture' which was influenced by esthetics and appearance of dentures, the difference in the results were statistically insignificant as 73.3% were fully satisfied with conventional complete dentures and 66.6% were fully satisfied with upper conventional and lower relined mandibular dentures (Table 10). It might be due to the reason that only the intaglio surface of mandibular complete dentures was different, all other factors being similar in both the dentures and it did not affect the 'other people's likeness towards patients' denture'.

Though all the patients were more satisfied and preferred relined mandibular dentures, three of the patients reported breakage of their relined mandibular dentures. It might be due to the fact that the relining of lower dentures decreased the thickness of denture base material which weakened the dentures resulting in breakage. Also, the fracture of lower dentures at the midline region could have been due to the decrease in flexural resistance because of relining with soft liner material. One of the noticeable feature was that in case of relined dentures, not even a single denture demonstrated debonding of heat cured silicone based resilient liner from denture base resin suggesting a good bond strength between the two.

The limitations associated with the present study can be cited as that the sample size was small and the subjects with only well formed Class 1 edentulous alveolar ridges were selected. The study period was also short as the clinical outcomes were measured at six weeks following the final adjustments and the viscoelastic properties of relined mandibular dentures might change with time. A longer follow up might have conceded slightly different results. Soft denture liners also have several problems associated with their use such as loss of softness, water sorption and solubility, colonization of candida albicans and adhesion failure between liner and denture base. Therefore, it should be acknowledged that there are limitations to this study and the results are not applicable to all edentulous patients. Hence, an in depth investigation of the exceptions and indications for a permanent resilient liner is required before the selection of an edentulous patient as a candidate for the use of relined dentures.

Conclusion

Within the limitations of this study, it can be concluded that denture soft liner has a considerable role in improving the patients satisfaction with their dentures because of its cushioning effect and ability to redistribute the masticatory forces transmitted to the denture bearing area.

Clinical Significance

The results of this study may aid in clinically recommending a treatment option for edentulous or dentally crippled patients to improve their satisfaction in terms of comfort, fit, esthetics, ability to chew and speech with their mandibular dentures.

Reference

1. Babu BD, Jain V, Pruthi G, Mangtani N, Pillai RS. Effect of denture soft liner on mandibular ridge resorption in complete denture wearers after 6 and 12 months of denture insertion: A prospective randomized clinical study.' J Indian Prosthodont Soc 2017;17:233-238.
2. Chaldek G, Zmudzki J, Kasperski J. Long -term soft denture lining materials.' Materials, 2014;7:5816-5842.
3. Crum RJ, Loiselle RJ, Rooney GE.' Clinical use of a resilient mandibular denture.' JADA, 1971;83:1093-1096.
4. Dootz ER, Koran A, Craig RG. Physical property comparison of 11 soft denture lining materials as a function of accelerated aging', J. Prosthet. Dent 1993;69(1):114-119.
5. Hayakawa I, Hirano S, Takahashi Y, Keh En S. 'Changes in the masticatory function of complete denture wearers after relining the mandibular denture with a soft denture liner', Int J Prosthodont 13(3):227-231.
6. Kar S, Tripathi A, Fatima T. A comparative study of masticatory performance in complete denture patients

- before and after application of soft liner', Med J Armed Forces India 2018, 1-7.
7. Kawano F, Dootz ER, Koran A, Craig RG. Comparison of bond strength of six soft denture liners to denture base resin', J. Prosthet. Dent 1992;68(2):368-371.
 8. Kimoto S, Kimoto K, Gunji A, Kawai Y, Murakami H, Tanaka K *et al.* Effects of resilient denture liner in mandibular complete denture on the satisfaction ratings of patients at the first appointment following denture delivery', J Jpn Prosthodont Soc, 2008;52:160-166.
 9. Kimoto S, Kitamura M, Kodaira M, Yamamoto S, Ohno Y, Kawai Y *et al.* Randomized controlled clinical trial on satisfaction with resilient denture liners among edentulous patients', Int J Prosthodont 2004;17(2):236-240.
 10. Kimoto S, Kimoto K, Kawai Y, Murakami H, Atsuko G, Ojawa A, *et al.* Effect of an acrylic resin - based resilient liner applied to mandibular complete dentures on satisfaction ratings among edentulous patients, Int J Prosthodont 2014;27:561-566.
 11. Kimoto S, So K, Yamamoto S, Ohno Y, Shinomiya M, Ogura K *et al.* Randomized controlled clinical trial for verifying the effect of silicone based resilient denture liner on the masticatory function of complete denture wearers', Int J Prosthodont 2006;19(6):593-600.
 12. Kreve S, Dos Reis A. 'Denture liners: A systematic review relative to adhesion and mechanical properties', The Scientific World Journal 2019, 1-12.
 13. Mangtani N, Pillai RS, Babu BD, Jain V. Effect of resilient liner on masticatory efficiency and general patient satisfaction in completely edentulous patients'. J Dent Specialities 2015;3(2):150-155.
 14. Murata H, Hamada T, Sadamori S. Relationship between viscoelastic properties of soft denture liners and clinical efficacy.' J. Dent Science Review 2008;44(2):128-132.
 15. Parker S, Riggs PD, Braden M, Kalachandra S, Taylor DF. 'Water uptake of soft lining materials from osmotic solutions.' J Dent, 1997;25:297-304.
 16. Pisani MX, Malheiros-Segundo, A de L, Balbino KL, de Souza RF, Paranhos H de FO *et al.* Oral health related quality of life of edentulous patients after denture relining with a silicone-based soft liner.' Gerodontology 2012;29:e474-480.
 17. Shinomiya M. *In vivo* and in-vitro studies for analysis of mastication in complete denture wearers with resilient denture liners', Int J Oral- Med Sci 2007;5(2):107-116.
 18. Waters MGJ, Jagger RG, Jerolimov V, Williams KR. Wettability of denture soft - lining materials', J. Prosthet. Dent 1995;74(6):644-646.
 19. Winkler S. Essentials of complete denture prosthodontics, Mosby, St. Louis 1988,
 20. Wright PS. Observations on long-term use of a soft-lining material for mandibular complete dentures.' J. Prosthet. Dent. 1994;72:385-392.
 21. Yoneyama Y, Tojyo T, Ohkubo C, Hosoi T Pressure distribution of mandibular complete denture using soft lining materials', Int Chin J Dent 2010;10:17-21.