



A Clinical Study to Evaluate and Compare the Masticatory Performance in Complete Denture Wearers with and without Soft Liners

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ABSTRACT

Aims and objectives: Soft liners are mainly used with complete dentures in case of poor mucosal conditions and for the even distribution of masticatory forces. However, there is some doubt as to whether the elasticity of the soft liner disturbs masticatory function because denture wearers may need extra force to compress the soft liners, leading to muscle fatigue. So, this clinical study was done to evaluate and compare the masticatory performance in patients wearing complete dentures with and without the use of soft liners.

Materials and methods: Twenty edentulous subjects were selected for the study. For each patient two sets of complete dentures were fabricated. First set without the use of soft liner and the second one for using with soft liner. Peanuts were selected as test food for the study and the chewed food was pooled for a single measurement and then poured on sieves. Both filter and filtrate were collected and was centrifuged. Masticatory performance in this study has been quantitated by dividing the volume of test food passing through the sieve by the total volume of test food recovered. The fraction is then expressed as a percent.

Results: With the paired t-test performed, significant difference was found between the masticatory performance in patients wearing complete dentures with and without the use of soft liners. 5% difference was seen in the mean performance.

Conclusion: It has been concluded from this study that, masticatory performance in patients wearing complete dentures with the use of soft liners was improved by 5% when compared to the patients wearing complete dentures without using soft liners.

Clinical significance: This present study indicates that the masticatory performance enhanced with the use of soft liners for complete denture patients.

Keywords: Masticatory performance, Complete denture, Soft liner.

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INTRODUCTION

One of the primary functions of the complete denture is to restore masticatory function in the people who have lost their natural teeth. Studies¹ have reported that the values for maximum biting force in patients wearing complete dentures were only one fifth to one-sixth the values reached by dentate subjects. In dental literature, the terms 'Masticatory performance' and 'Masticatory efficiency' have been used interchangeably. Some authors² have suggested an important distinction between these two terms. They defined masticatory performance in terms of—the percentage particle size distribution of food when chewed for a given number of strokes. Due to the presence of thin and relatively nonresilient mucosa or due to severe alveolar resorption, some edentulous patients are uncomfortable with the hard acrylic bases of the conventional dentures.³ This in turn will cause inefficiency in masticatory performance and uneven distribution of occlusal forces causing pain and discomfort to the patient. In these situations soft lining materials can be applied temporarily or permanently to the tissue surface of a denture base to distribute the pressure uniformly over the supporting tissues depending on their condition. The viscoelastic properties of these materials give the cushioning effect which allows even distribution of occlusal forces and helps in maintaining the health of the supporting tissues.⁴

Some investigators⁵ have found no difference in the chewing efficiency between the complete dentures with and without the use of soft liners. Contradicting to this statement others authors⁶ have stated that the use of soft liner in complete dentures can improve the masticatory performance.

Hence, this study was undertaken to evaluate and compare the masticatory performance in patients wearing complete dentures with and without the use of temporary soft liners.

MATERIALS AND METHODS

The present study was conducted in the Department of Prosthodontics, Bapuji Dental College and Hospital, Davangere, India.

Patient Selection Criteria

Total of 20 completely edentulous patients undergoing complete denture treatment were selected for the study. Subjects were randomly selected for the study.

Inclusion Criteria

1. Patients with well-formed residual alveolar ridges with adequate interridge space.
2. Patients with good neuromuscular control and without any temporomandibular disorders.

Fabrication of Complete Denture for the Study

For each individual patient, two sets of maxillary and mandibular conventional acrylic complete dentures were fabricated. For the study purpose, subjects wearing complete dentures were divided into two groups:

- *Group 1:* Complete dentures without the use of soft liner.
- *Group 2:* Complete dentures with the use of soft liner.

Fabrication of Complete Denture for Group 1

To accomplish the first objective that is to evaluate the masticatory performance of complete dentures without the use of soft liner, first set of complete dentures were fabricated following all the clinical and laboratory procedures in the conventional manner.

Fabrication of Complete Denture for Group 2

To accomplish the second objective, second set of complete dentures were fabricated by providing 2 mm space for the use of soft liner. First 2 mm of wax spacer was adapted on the maxillary and mandibular master casts providing the appropriate tissue stoppers (Figs 1 and 2), which were duplicated using alginate. The second set of complete dentures was fabricated on these duplicated master casts (Fig. 3) following all clinical and laboratory procedures as done in the fabrication of first set of complete denture.

Application of Soft Liner

At the time of insertion, following manufacturer's instructions, autopolymerized soft liner (Fig. 4—GC



Fig. 1: Maxillary master cast with 2 mm wax spacer



Fig. 2: Mandibular master cast with 2 mm wax spacer

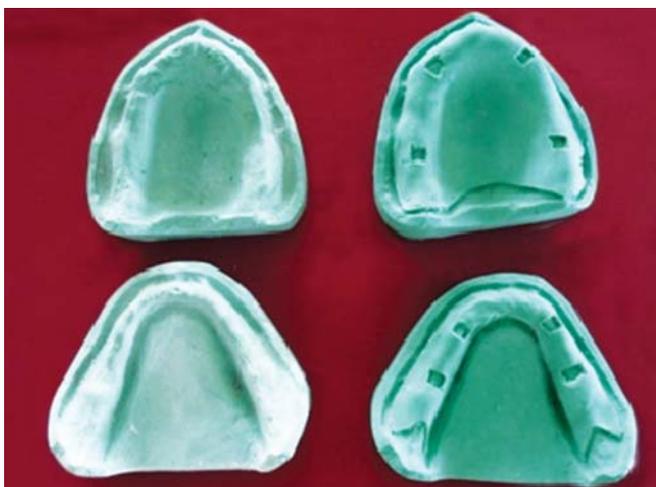


Fig. 3: Duplicated master casts

RELINTM ExtraSoft, GC Company, USA) was applied to the space provided on the tissue surface of second set of complete denture using auto mixing gun. Complete dentures were then placed in the patient's mouth and the functional molding was done utilizing the chairside method. Excess material was removed, finished and polished (Fig. 5).



Fig. 4: Soft liner



Fig. 6: Test food, peanuts

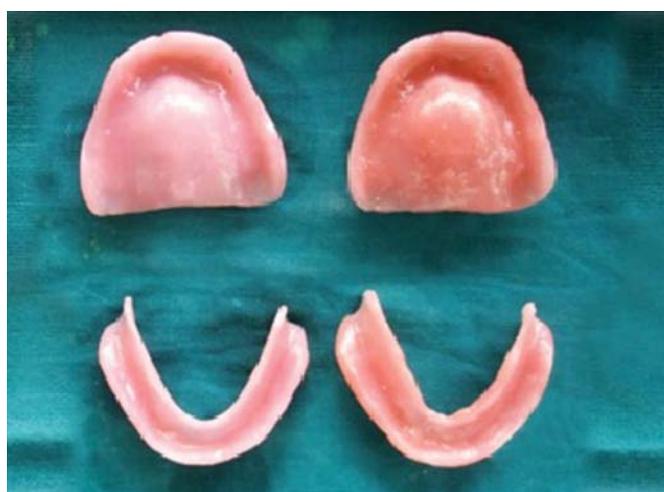


Fig. 5: Complete dentures without and with soft liner

Evaluation of the masticatory performance in patients wearing complete dentures was done after 2 weeks of adaptation period. Patient was instructed to use the complete denture without the use of soft liner and was recalled after 2 weeks to evaluate the masticatory performance. Then the complete denture with the use of soft liner was inserted and again patient was recalled after 2 weeks to evaluate the masticatory performance. Same procedure was followed for all the 20 patients. Necessary adjustments of the complete denture were done in the 2 weeks of adaptation period.

Method Employed for the Evaluation of Masticatory Performance

Method⁷ for the evaluation of masticatory performance was same for both the dentures. The test food selected for the study was peanuts because it is homogenous, inexpensive and it also offers moderate resistance to chewing. Three test portions of 3gm each were used to measure masticatory performance (Fig. 6). Each portion was chewed with 20 masticatory strokes. After the specified number of chewing

strokes, the chewed food was expectorated into a disposable cup, the mouth was rinsed twice with water, and the rinsed water was added to the cup. Same procedure was performed for all the 3 portions of test food. The chewed food was pooled for a single measurement and stirred with a glass rod to break up clumps of food and then poured on sieves of 2 and 1 mm sizes (Fig. 7). Since, no food was passed through 1mm sieve, the filtrate was discarded. The smaller particles were washed through the sieve. Both filter and filtrate were collected and transferred to the graduated centrifugal tube (Fig. 7). The tubes were centrifuged for 3 minutes at 1500 rpm. The volume of test material in each tube was recorded (Fig. 8). The total volume of the test food recovered was determined by adding the volumes of both the filter and filtrate. Same procedure was performed for both the complete dentures for all the patients.

Masticatory performance in this study has been quantitated by dividing the volume of test food passing through the sieve by the total volume of test food recovered. The fraction is then expressed in a percentage for the evaluation of masticatory performance.



Fig. 7: Standardized sieves and centrifugal tubes



Fig. 8: Measurement of volume after centrifuge

RESULTS

The values were obtained and the statistical analysis of these tabulated values was done to evaluate and compare the masticatory performance in both the groups.

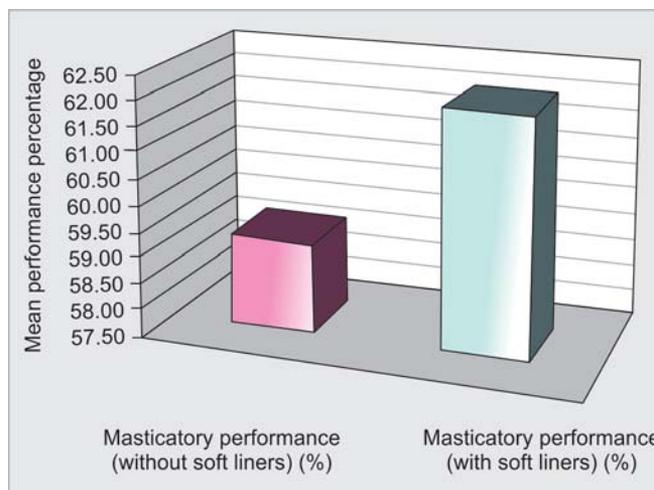
All the statistical calculations were done through SPSS (Statistical Presentation System Software) for windows version 14.0, Evaluation version (SPSS, 2005. SPSS Inc, New York).

The results obtained from the study are shown in Tables 1, 2 and Graph 1.

Higher masticatory performance values were noted for all the patients after placing the complete denture using soft liners except for one patient.

The analysis of the results showed significant difference in the masticatory performance between the patients wearing complete dentures without and with use of soft liners. Highly significant difference ($p < 0.001$) was found between the two groups (Groups 1 and 2).

With the use of soft liners in complete dentures, 5% improvement was seen in the masticatory performance of



Graph 1: The mean of masticatory performance of study groups which was 59.22% for complete dentures without the use of soft liners (group 1) and 62.06% for complete dentures with the use of soft liners (group 2)

the patient when compared to the complete dentures placed without using soft liners.

DISCUSSION

Complete dentures are unyielding units and may be best described as rigid prosthesis.⁸ In dentulous subjects, the periodontal ligament being resilient serves to cushion the impacting forces (viscoelastic theory) applied to natural teeth.⁹ The same principle can be used in dentures in which an elastic material like soft liner can be on the tissue surface of the denture to absorb some of the forces imparted during function so that the trauma to the basal seat would be reduced and the forces would be more widely distributed over the basal seat. The rationale of the use of soft liner under the denture has been described as the replacement of missing resilient tissue layer covering the residual ridge by a similar layer on the base of the denture.¹⁰ It usually acts as a cushion between the hard denture base and the supporting tissues.

Table 1: The masticatory performance in patients wearing complete dentures without the use of soft liners which ranges from 34.05 to 88.49% with standard deviation of $\pm 16.68\%$ and 36.23 to 89.2% for complete dentures with soft liners with standard deviation of $\pm 16.40\%$. Mean masticatory performance of patients was found to be 59.22% for complete dentures without the use of soft liners and 62.06% for complete dentures with the use of soft liners

Study groups	Range (%)	Mean (%)	Standard deviation (%)
Masticatory performance (without soft liners) (%)	34.05-88.49	59.22	16.68
Masticatory performance (with soft liners) (%)	36.23-89.2	62.06	16.40

Table 2: The percentage difference in mean of masticatory performance of patients wearing complete dentures without and with the use of soft liners paired t-test was performed and it was found that there was a 5% difference in the mean of masticatory performance ratio with highly significant p-value ($p < 0.001$)

Study groups	Mean \pm SD	Difference in the mean performance ratio	t*-value	p-value
Masticatory performance (without soft liners) (%)	59.22 \pm 16.68	5%	5.15	p < 0.001 Highly significant
Masticatory performance (with soft liners) (%)	62.06 \pm 16.04			

*Paired t-test

Loading of the denture base leads to compressive forces acting on the underlying mucosa, which may result in catabolic activity in the underlying bone and more rapid ridge resorption. Soft liners on the tissue surface of complete denture is a good treatment option for patients who have severely reduced residual alveolar ridges and cannot tolerate conventional hard acrylic resin denture bases because of thin and resilient mucosa.^{5,10,11} Soft liners have been recommended to prevent the excessive pressure on residual alveolar ridges and to provide a more uniform load distribution by absorbing the mechanical shock caused by masticatory forces.^{4,5,11-13} Authors have stated that the use of soft liners can reduce the transmitted forces from 20 to 60% and act as stress regulators.¹³

Soft liners can also be indicated in case of traumatic ulcerations associated with wearing of complete denture, sharp spiny ridge crests, obturators, maintenance of immediate dentures, maxillary and mandibular tori and prominent mylohyoid ridge.¹¹⁻¹⁴ They are more beneficial in the edentulous mandible because the mandible has smaller area of fitting surfaces than the maxilla to cope with the whole functional load.⁵

Investigators¹⁵ have shown that even the well-adapted complete dentures on good alveolar ridges move as much as 2.3 mm from their original positions during mastication. When a denture moves on its tissue base during function, there is a tendency for the border seal to be broken. With the resilient complete denture, the forces of the tongue and of buccal musculature act to mold the denture borders toward the alveolar ridge during function. This maintains the integrity of the border seal and there by improves the retention of the denture.

Authors⁶ have reported that the number of occlusal contacts tended to increase when using soft lined dentures and suggested that the deformation of soft lining materials can cause a slight movement of the mandibular dentures into the most stable position. During mastication, the soft lining material may also improve the occlusal balance by its deformation because of its elasticity, and consequently the masticatory performance could increase. It was also reported that the lined denture significantly increases the maximum biting force which in turn increase the masticatory performance.

The final selection of the soft liner was based on ease of manipulation, adaptability and bonding with the denture base resin. Soft liner of 2 mm thickness was applied because it had been reported that 2 to 3 mm thickness of soft lining material was most suitable for improving the pressure distribution on supporting tissues under the denture.^{4,14}

Numerous foods including peanuts, carrots, ham, coconut, lettuce, apples, almonds, rice and other artificial

test foods like Optosil,¹⁶ synthetic materials have been used as test foods in the previous investigations to evaluate the masticatory performance. In the present study, peanut was used as test food as it offers moderate resistance to mastication in patients with complete dentures. It was considered palatable, inexpensive and homogeneous.

The overall analysis of the results obtained in the present study showed 5% improvement in the mean of masticatory performance of complete dentures with the use of soft liners with highly significant p-value ($p < 0.001$). The results indicate that complete dentures with the use of soft liners provide better masticatory performance in comparison to complete dentures without the use of soft liners. So, soft liners can be advised in patients who have severely resorbed residual ridges and also in patients who cannot tolerate conventional hard acrylic resin denture bases because of underlying thin and nonresilient mucosa. Consideration should be given to the condition of the supporting tissues.

CONCLUSION

This clinical study was planned to evaluate and compare the masticatory performance in patients wearing complete dentures with and without the use of soft liners.

Within the limitations of this study and considering the small sample size. Significant differences were seen between the masticatory performances of patients wearing complete dentures without and with the use of soft liners.

Five percent improvement in masticatory performance was seen in the patients wearing complete dentures when compared to the patients wearing complete dentures without the use of soft liners.

CLINICAL SIGNIFICANCE

Soft liners can be advised in patients having poor mucosal conditions, tissue soreness and in cases of resorbed ridges. Further studies are required to evaluate the masticatory performance of complete dentures with the use of long-term soft liners considering both the acrylic and silicone soft liners.

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