

Original Article



Efficacy of Denture Adhesives in Neuromuscular Adaptation to Mandibular Complete Dentures

Tabassum Ajmal¹, Asifullah Khan^{*2}, Mariya Khalid², Jawad Rafique², Mashal Hamid², Sarah Khan²

¹ Department of Prosthodontics, Sardar Begum Dental Hospital, Peshawar- Pakistan

² Department of Prosthodontics, Khyber College of Dentistry, Peshawar- Pakistan

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Corresponding Author

Asifullah Khan
Department of Prosthodontics
Khyber College of Dentistry,
Peshawar- Pakistan.
Email: drasifullah@hotmail.com

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Abstract

Objective: To determine the efficacy of denture adhesive use on neuromuscular adaptation of mandibular complete dentures during initial phase after complete denture insertion with adhesive compared with conventional use without adhesive.

Methodology: A total of 60 patients (30 in adhesive and 30 in conventional group) were included by non-probability sampling technique from 20th February 2022 to 20th August 2022. Completely edentulous patients, having 2-4 Atwood's ridge classification, age between 40-80 years and those who were provided with new complete maxillary & mandibular dentures for the first time were included. Patients with severely resorbed ridges and on medication causing xerostomia like antihypertensive and antidepressants were excluded. The questionnaire included 3 questions regarding each parameter (i.e phonation, chewing, retention, mandibular denture movement during function).

Results: Mean age was 56.48±8.52 years. The male patients were 36 (60%) and female patients were 24 (40%). The frequency of satisfied patients was higher in adhesive group (n=25, 83.33%) than conventional group (n=2, 6.67%) (p<0.001). Similarly, for eating soft food and semi hard food with denture, frequency of satisfied patients was higher in adhesive group (n=28, 93.33%) than conventional group (n=11, 36.67%) (p<0.001). For adhesive group n=22 (73.33%) were satisfied and for conventional group n=4 (13.33%) were satisfied for "denture drop while talking" (p<0.001). Similar results were found for "denture drop while eating". For adhesive group n=23 (76.67%) were satisfied and for control group n=2 (6.67%) were satisfied for "denture movement during talking" (p<0.001).

Conclusion: Within the limitations of this study, denture adhesive use in patients with mandibular complete dentures resulted in significantly improved patient-reported outcomes compared to conventional denture use without adhesive. Use of denture adhesives is recommended during initial phase after insertion of complete denture to help in easy adaptation.

Keywords: Neuromuscular adaptation, denture wearers, denture adhesive

Introduction

Satisfying edentulous patients with conventional complete dentures is a great challenge for prosthodontists.¹ Mucosa borne complete dentures is the most commonly adopted treatment option for edentulous patient.² Common post insertion problems associated with complete dentures may include discomfort associated with dentures, looseness of dentures, support problems and problems associated with retention and stability.^{3,4} The mandibular denture is commonly more problematic as compared to maxillary denture due to smaller surface area coverage of the foundation tissues.² Sometimes new removable dental prosthesis dislodges because of tongue size and activity.¹ Learning to chew satisfactorily with new dentures usually takes at least 6-8 weeks. The muscles of the tongue, cheeks and lips must be trained to maintain the dentures in position on the residual ridges during mastication.³

Many treatment options have been opted to overcome the problems of retention in complete dentures such as over dentures, implants and denture adhesives. Among these, the denture adhesives are considered as an alternative, useful adjunct to the denture treatment, as they provide quick, easy to use and economic application.⁵ It is seen that denture adhesives improve the adaptability of new prosthesis; however, its application routinely in initial phase after insertion of complete denture to get better neuromuscular adaptability should be evaluated.⁶

According to a study, a significant increase in masticatory performance was noted after using cream and powder adhesives.⁷ However, in another study, it was shown that 23.3% of the patients considered the comfort and retention of their mandibular dentures as good as when denture adhesive was not used.⁸

In literature, only limited parameters e.g. chewing or phonation have been assessed with the use of denture adhesives. This study assessed these parameters in more detail and evaluated patient's satisfaction with the use of denture adhesive in initial phases of complete denture in local population. The results of the study can be used to recommend denture adhesive in initial phases of complete denture therapy to get relatively quicker neuromuscular adaptability⁵ which in this study was assessed indirectly through changes in patient-reported outcomes after the 3-week follow-up period.

Methodology

This Quasi experimental study was conducted in Prosthodontics department of Khyber college of Dentistry Peshawar after approval from ethical board committee of the institute. Sample size was calculated using WHO sample size calculator, the calculated sample size was 17 by taking 23.3% frequency of comfort (denture adhesive not used) and 76.7% frequency of comfort8

(denture adhesive used) while keeping 80% power of the test and 5% margin of error. But in order to fulfil normality assumption of the data, total sample size of 60 (30 in each group) were taken. Sampling technique was Non-Probability consecutive. Patients between age 40-80 with edentulous maxillary and mandibular jaws coming to prosthodontics department for complete denture treatment were evaluated through clinical examination. Those having 2-4 Atwood's ridge classification and those who would be provided with maxillary and mandibular complete dentures for the first time were included in the study whereas patients with severely resorbed ridges and those on medication causing xerostomia like antihypertensive and antidepressants were excluded. Following denture insertion, all participants underwent routine post-insertion adjustments to relieve pressure areas and optimize fit and comfort. Denture adhesive was used after completion of these standard adjustments.

Data Collection Procedure:

Ethical committee approval was taken. Participants coming to the prosthodontic department of Khyber College of Dentistry who fulfilled the inclusion criteria were invited to take part in the study. The purpose, procedure and benefits of the study was explained to them. Their willingness and participation in the study was ensured through oral informed consent. They were assured of maintaining confidentiality of their personal and other data collected from them. Participants were divided in to two groups. One group (interventional group) having Atwood's ridge 2-4 was provided with denture adhesive "Protifex" (powder form because of its affordability to common people) on the day of insertion of mandibular complete denture, while the other group (conventional group) did not use denture adhesive. All participants received standardized patient education regarding denture use and maintenance, including information on potential short-term complications such as mucosal soreness, irritation, increased salivation, and difficulty in mastication and speech. They were advised to report any persistent discomfort during follow-up visits. Participants for both groups were selected randomly by choosing every patient on his/her entrance in the prosthodontic ward, he/she was labelled of odd and even number group e.g. first patient of the day was included in odd group while the second patient was included in the even group. The odd group was considered as conventional group while the even group was considered as interventional group. Participants were followed over a 3-week period, with an initial evaluation at 24-48 hours post-insertion following standard denture adjustments and subsequent weekly follow-up visits. During this period, any patient-reported complaints were addressed, and necessary denture adjustments were performed to improve comfort and function. The questionnaire was administered at the end of the 3-week follow-up period to assess overall patient adaptation to the

prosthesis. The clinical parameters assessed included speech difficulty (phonation), chewing efficiency (with soft, medium, and hard food), Denture retention and mandibular denture movement during function.

Data Analysis Procedure:

Data analysis was done through SPSS version 22, continuous variables like age was presented in the form of mean and standard deviation while categorical variables like gender and efficacy was presented in the form of frequency and percentage. Fisher exact test was applied to compare the two groups (interventional and conventional group) with adhesive adaptation (yes/no) as few cells had frequency ≤ 05 . P-value ≤ 0.05 was taken as significant.

Results

Mean age was 56.48 ± 8.52 years with range from 40 to 70 years. There were 36 (60%) males and 24 (40%) females. The most common age group was 61-70 years with 24 (40%) participants. (Table 1).

The frequency of satisfied patients was higher in adhesive group ($n=25$, 83.33%) than conventional group ($n=2$, 6.67%) ($p<0.001$) for talking with denture. (Table 2)

The frequency of satisfied patients was higher in adhesive group ($n=28$, 93.33%) than conventional group ($n=11$, 36.67%) ($p<0.001$) for eating soft food with denture. Similar result was found for eating semi-hard and hard food with denture ($p<0.001$). (Table 3)

For adhesive group $n=22$ (73.33%) were satisfied and for conventional group $n=4$ (13.33%) were satisfied for denture drop. ($p<0.001$). Similar results were found for denture drop while eating. (Table 4)

For adhesive group $n=23$ (76.67%) were satisfied and for control group $n=2$ (6.67%) were satisfied for denture movement during talking and difference was statistically significant ($p<0.001$). Similar results were found for denture movement during eating and smiling. (Table 5)

Discussion

This study was conducted to determine the efficacy of denture adhesives in neuromuscular adaptation of mandibular complete denture in initial phases of complete denture therapy by comparing interventional group (denture adhesive) with control group (no denture adhesive). Many treatment options have been opted to overcome the problems of retention in complete dentures such as over dentures, implants and denture adhesives. Among these, the denture adhesives have been considered a useful adjunct to the denture treatment, as they provide quick, easy to use and economic application.⁵

The present study was conducted on 60 patients who were provided with new set of complete dentures. This study showed significant results for neuromuscular adaptation in initial phases of mandibular complete denture therapy as shown by parameters mentioned in results.

Shirin et al.⁹ determined the effect of denture adhesives on efficiency of complete dentures in patients with different alveolar ridges in a cross-over randomized clinical trials study who were wearing well fitted complete dentures. Group I with mild resorption, group II with moderate resorption, and group III with severe resorption. The patients who had recently received their dentures after their primary complications had been resolved, they were asked to use denture adhesive according to the instructions. Increased retention and adaptation made 64.4% of these patients willing to continue using the adhesive after the study. 43% of patients reported moderate satisfaction of using this adhesive. Similar results have been found in our study shown by greater number of patients who were satisfied because of decreased "denture drop" and "denture movement" during eating, talking and smiling with the use of denture adhesive indicating increased retention and stability of mandibular complete denture.

According to a study conducted by Noberto Martins et al, a significant increase in masticatory performance was noted after using cream adhesives mean 32.6% and powder type adhesive mean 31.2% when compared with the control group mean 19.8%.⁷ In our study eating efficiency has been improved in 93.33% of the patients while eating soft food and 86.67 % while eating semi hard food who had been using denture adhesive in mandibular complete denture.

In a study by Danny Omar Mendoza Marin et al⁸, it was shown that 23.3% of the patients considered the comfort and retention of their mandibular dentures as good when denture adhesive was not used. On the other hand major improvement was noted in these parameters after use of denture adhesive ($P<0.05$) with 76.7% (comfort) and 83.3% (retention) of the patients considering the comfort and retention of their mandibular complete dentures as good.⁸ These results are coincident with our results in which denture drop (retention) had been decreased in 73.33% of the patients using denture adhesive.

In another study by Psillakis et al.¹⁰ patient perceptions were analyzed by a questionnaire for denture performance as well as the effects on speaking and chewing, fit and comfort, and perceived confidence. There was a 63.4% improvement in bite force dislodgement with the use of a denture adhesive. Similar results have been found in our study showing significant improvement in talking (83.33 % satisfaction) and eating with denture (93.33 % patients were satisfied for eating soft food and 86.67 % for eating semi hard food) with the use of denture adhesive.

Table 1. Frequency of gender and age

Variable	Characteristic	n(%)
Gender	Female	24 (40.00)
	Male	36 (60.00)
Age group (years)	40-50	15 (25.00)
	51-60	21 (35.00)
	61-70	24 (40.00)

Table 2. Comparison of talking with denture between adhesive and conventional group

Characteristic	Adhesive, N = 30	Conventional, N = 30	p-value
Difficulty in talking			<0.001
Neutral	2 (6.67)	15 (50.00)	
Satisfied	25 (83.33)	2 (6.67)	
Unsatisfied	3 (10.00)	13 (43.33)	

*Fisher exact test

Table 3. Comparison of eating with denture between adhesive and control group

Characteristic	adhesive, N = 30	Conventional, N = 30	p-value*
Eating soft food			<0.001
Neutral	2 (6.67)	10 (33.33)	
Satisfied	28 (93.33)	11 (36.67)	
Unsatisfied	0 (0.00)	9 (30.00)	
Eating semi hard foods			<0.001
Neutral	4 (13.33)	21 (70.00)	
Satisfied	26 (86.67)	3 (10.00)	
Unsatisfied	0 (0.00)	6 (20.00)	
Eating hard foods			<0.001
Neutral	24 (80.00)	11 (36.67)	
Satisfied	6 (20.00)	2 (6.67)	
Unsatisfied	0 (0.00)	17 (56.67)	

*Fisher exact test

The study was conducted with a relatively small sample size (n=60), which may limit the generalizability of the results to the broader population of complete denture wearers. The study duration was short and limited to the initial post-insertion phase; long-term adaptation and retention outcomes were not evaluated. Only subjective assessment through a questionnaire was employed; objective clinical measures (e.g., masticatory efficiency tests, electromyographic analysis) were not included.

Conclusion

From this study it is concluded that denture adhesive can be used in first 3-4 weeks of new complete denture therapy to obtain quicker neuromuscular adaptation particularly with mandibular denture which will improve patient's confidence.

References

Table 4. Comparison of stability with denture between adhesive and control group

Characteristic	Adhesive, N =30	Conventional N = 30	p-value*
Denture drop while talking			<0.001
Neutral	5 (16.67)	16 (53.33)	
Satisfied	22 (73.33)	4 (13.33)	
Unsatisfied	3 (10.00)	10 (33.33)	
Denture drop while eating			<0.001
Neutral	5 (16.67)	16 (53.33)	
Satisfied	21 (70.00)	5 (16.67)	

*Fisher exact test

Table 5. Comparison of movement with denture between adhesive and conventional group

Characteristic	Adhesive, N =30	Conventional N = 30	p-value*
Denture movement during talking			<0.001
Neutral	5 (16.67)	13 (43.33)	
Satisfied	23 (76.67)	2 (6.67)	
Unsatisfied	2 (6.67)	15 (50.00)	
Denture movement during eating			<0.001
Neutral	5 (16.67)	13 (43.33)	
Satisfied	22 (73.33)	4 (13.33)	
Unsatisfied	3 (10.00)	13 (43.33)	
Denture movement during smiling			<0.001
Neutral	7 (23.33)	13 (43.33)	
Satisfied	21 (70.00)	2 (6.67)	
Unsatisfied	2 (6.67)	15 (50.00)	

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Authors' Contribution Statement

TA contributed to the conception, design, acquisition, analysis, interpretation of data, and drafting of the manuscript. AK contributed to the design, acquisition, analysis, and interpretation of data. MK contributed to the conception, design, acquisition, critical review of the manuscript, and final approval of the version to be published. JR contributed to the analysis, interpretation of data, and drafting of the manuscript. MH contributed to the analysis, interpretation of data, and drafting of the manuscript. SK contributed to the analysis, interpretation of data, and drafting of the manuscript. All authors are accountable for their work and ensure the accuracy and integrity of the study.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.