

IMPACT OF REMOVABLE PARTIAL DENTURE ON MASTICATION AND ORAL HEALTH RELATED QUALITY OF LIFE IN PATIENTS WITH SHORTENED DENTAL ARCH

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Abstract: A retrospective study was conducted in the Department of Prosthodontics, LUMHS Jamshoro, from January 2022 to January 2023 to assess the effect of removable partial dentures (RPD) on oral health-related quality of life (OHRQoL) and masticatory performance (MP) in patients with shortened dental arch. The study was conducted on a total of 19 patients. All included participants received RPD, and OHRQoL and MP were assessed after 2 weeks. The results showed that the MP score improved (177.45 ± 38.86) along with OHIP-14 domain scores (4.21 ± 4.22) after rehabilitation with RPDs. Hence, RPD effectively improves OHRQoL and MP in patients with mandibular SDA.

Keywords: Removable partial dentures, Shortened dental arch, Masticatory performance, Oral health

Introduction

Many people become partially edentulous in their old age, and posterior teeth are at higher risk due to substantial occlusal stress and difficulty cleaning posterior dentition (Kinoshita et al., 2021). Partial edentulism with missing posterior teeth is called shortened dental arch (SDA) (Schierz et al., 2021). Partial edentulism affects masticatory performance (MP), food selection, oral health-related quality of life (OHRQoL), and psychosocial activity (McLister et al., 2018). Prosthodontics rehabilitation aims to restore masticatory function, as chewing is essential for both general and oral health. Masticatory inefficiency causes nutritional deficiency and shifts nutrition towards a softer diet. Edentulism associated with soft diet feeding is a risk factor for Alzheimer's disease and dementia (da Rocha et al., 2021). Rehabilitation options for partially edentulous patients include implant-supported removable partial dentures (RPDs), implant-supported fixed prostheses, cantilevered fixed prostheses, and conventional RPD. RPD is most common as it is inexpensive, non-invasive, and simple, though it is associated with a high risk of caries and periodontal disease in the abutment teeth (Bandiaky et al., 2022). Due to sufficient retentive capacity, the SDA concept was introduced,

in which missing posterior teeth were replaced till second premolars, ideally in patients with four occlusal units. WHO also proposes this concept in adult patients. Some studies have reported the effectiveness of this concept for oral function and comfort, periodontal support, and occlusal stability (Reissmann et al., 2019). However, some studies reported that using the SDA concept increased the risk of premolar mobility, affecting brain activity and temporomandibular joint function (Walter et al., 2021). There are contraindicatory opinions about the use of the SDA concept and RPDs. Thus, this study aims to assess the effect of RPDs on OHRQoL and MP in patients with SDA.

Methodology

The retrospective study was conducted in the Department of Prosthodontics, LUMHS Jamshoro, from January 2022 to January 2023. The study included patients with partially edentulous mandibles who were aged between 45 to 70 years. Patients with temporomandibular joint disorders, periodontal and dental disease, mandibular tori, and uncontrolled diabetes mellitus were excluded. The study was

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conducted on a total of 19 patients. Informed consent of the participants was informed. The ethical board of the hospital approved the study.

Data including sex, age, denture experience, and time of edentulism were recorded. A mandibular removable partial denture (Kennedy Class I or Class II) was made for each patient. RPD was adjusted, and OHRQoL and MP were assessed after 2 weeks.

MP score was assessed using the glucose extraction method (Morita et al., 2018). Subjects were asked to chew gummy candy for 20 seconds. They were then given 10ml distilled water and were asked to expectorate water and bolus in a filter cup. The filtration was placed on a Glucosensor GS-II chip through a disposable collection brush. MP score was assessed by the concentration of dissolved glucose in the filtrate. This process was repeated thrice on every participant. MP score before and after inserting RPD was calculated.

OHRQoL was assessed through oral health impact profile (OHIP-14) questionnaires, which consisted of 14 items based on 7 domains (Silveira et al., 2019). Participants were asked about the frequency of the effect of every item. Responses were scaled from

0(never) to -4(very frequent). A total score was calculated by adding the score of all 14 items. A higher total score meant a lower OHRQoL. Responses were recorded before and after the insertion of RPD. SPSS version 23.0 was used for data analysis. Kolmogorov–Smirnov test was used for checking normality. For normally distributed data, paired t-test was used for intra-group comparison. The OHIP and MP scores' effect size (ES) was calculated. ES < 0.8 is considered significant, 0.4 is moderate, and 0.2 is negligible. P value < 0.05 is considered statistically significant.

Results

The men's age of the participants was 57 ± 8.22 years. There were 3 (15.7%) males and 16 (84.2%) females. The MP score improved significantly after rehabilitation (Table I). The OHIP-14 domain scores (individual and total) also improved significantly after rehabilitation (Table II). The subject comparison showed significant improvement in OHRQoL (ES = -1.55, P < .001) and MP (ES = 1.21, P < .001) after rehabilitation

Table I Masticatory performance before and after rehabilitation with removable partial dentures

Mean MP(mg/dL)		P value	
Before RPD	After RPD	t statistics	<0 .001
130.8 ±26.77	177.45 ±38.86	-5.455 (19)	

Table II Oral health impact profile score before and after rehabilitation with removable partial dentures

	Mean OHIP score		P value	
	Before RPD	After RPD	t statistics	
Total OHIP-14 score	15.86 ±8.86	4.21 ±4.22	6.983	<0.001
Domains				
Functional limitation	0.81 ±1.41	0.25 ±0.77	1.474	.154
Pain	4.01 ±1.76	1.61 ±1.33	4.867	<.001
Psychological discomfort	2.44 ±2.08	0.91 ±1.01	3.548	.002
Physical disability	3.55 ±2.34	0.31 ±0.91	7.426	<.001
Psychological disability	1.91 ±2.06	0.71 ±1.36	3.325	.003
Social disability	1.65 ±1.81	0.11 ±0.21	4.724	<.001
Handicap	1.51 ±1.44	0.26 ±.65	3.536	.002

Discussion

The impact of RPDs on OHRQoL and MP in patients with SDA was assessed in the current study. The results showed that RPDs are a practical option for improving masticatory performance (objective) and oral health-related quality of life (subjective). The subject comparison showed a significantly improved MP score, which implies that RPD balances occlusion. This is in line with the findings of a previous study by Sugio et al., which reported

improvement in MP score after restoration with RPD (Sugio et al., 2021). However, previous studies conducted by Alqutaibi et al. and Yoshimoto et al. showed that RPD had no significant impact on MP (Alqutaibi, 2020; Yoshimoto et al., 2023). This may be attributed to different study designs and variable methods for MP assessment. Previously, Manly's sieving method was standard for diagnosing MP. However, issues like the time-consuming nature and complicated manipulation raised questions over the method's credibility. Thus, alternative strategies like

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paraffin wax, silicone impression material, gummy jelly and chewing gum were introduced as a test food. The glucose extraction method was used in the current study due to its simplicity. A previous study conducted by Salazar et al. showed a positive correlation between the findings of the glucose extraction method and the sieving method (Salazar et al., 2019).

This study showed that RPD significantly improved OHRQoL in SDA patients. These findings align with the previous study's results (Reissmann et al., 2019). Moreover, the studies conducted on within-subject comparison of treatment outcomes of RPD showed significant improvement in OHRQoL (Nyan et al., 2019). On the other hand, the subject comparison showed that rehabilitation with RPD did not significantly impact OHRQoL (McKenna et al., 2020). Decreased quality of life can explain why missing teeth forced patients to seek prosthodontics treatment.

Regarding the individual OHIP-14 domain, the mean score in all domains improved significantly, except for functional limitation. Though the score reduced from 0.81 to 0.25, it was insignificant. The pain had the highest score before rehabilitation, patient mostly complained of difficulty in eating before treatment. This was due to pain on mastication and masticatory load on the masticatory mucosa and alveolar ridge in the edentulous area. A study conducted by Schierz O et al. showed that RPD significantly improved all OHIP domains (Schierz et al., 2021). However, a Study by Nakai et al. reported significant improvement in psychological discomfort and functional limitation only (Nakai et al., 2022). Another previous study reported an impact on all domains except handicap and functional limitation domains (Omo et al., 2016).

These few limitations of our study. It was conducted on a small sample, predominantly women, with a small follow-up time. A more extensive study with a generalized sample is suggested for further evaluation.

Conclusion

RPD is effective for improving OHRQoL and MP in patients with mandibular SDA.

Conflict of interest

The authors declared absence of conflict of interest.

References

Alqutaibi, A. Y. (2020). A within-subject comparison of the conventional clasp-retained with attachment-retained removable partial

dentures. *Journal of Taibah University Medical Sciences* **15**, 305-311.

- Bandiaky, O. N., Lokossou, D. L., Soueidan, A., Le Bars, P., Gueye, M., Mbodj, E. B., and Le Guéhenec, L. (2022). Implant-supported removable partial dentures compared to conventional dentures: A systematic review and meta-analysis of quality of life, patient satisfaction, and biomechanical complications. *Clinical and Experimental Dental Research* **8**, 294-312.
- da Rocha, M. C., da Rocha, D. M., Tribst, J. P. M., Borges, A. L. S., and Alvim-Pereira, F. (2021). Reduced periodontal support for lower central incisor-A 3D finite element analysis of compressive stress in the periodontium. *J. Int. Acad. Periodontol* **23**, 65-71.
- Kinoshita, K., Ogino, Y., Oki, K., Yamasaki, Y., Tsukiyama, Y., Ayukawa, Y., and Koyano, K. (2021). A prospective comparative study of mastication predominance and masticatory performance in Kennedy class I patients. In *"Healthcare"*, Vol. **9**, pp. 660. MDPI.
- McKenna, G., Tada, S., McLister, C., DaMata, C., Hayes, M., Cronin, M., Moore, C., and Allen, F. (2020). Tooth replacement options for partially dentate older adults: A survival analysis. *Journal of Dentistry* **103**, 103468.
- McLister, C., Donnelly, M., Cardwell, C. R., Moore, C., O'Neill, C., Brocklehurst, P., and McKenna, G. (2018). Effectiveness of prosthodontic interventions and survival of remaining teeth in adult patients with shortened dental arches—A systematic review. *Journal of Dentistry* **78**, 31-39.
- Morita, K., Tsuka, H., Kato, K., Mori, T., Nishimura, R., Yoshida, M., and Tsuga, K. (2018). Factors related to masticatory performance in healthy elderly individuals. *Journal of prosthodontic Research* **62**, 432-435.
- Nakai, N., Kurogi, T., and Murata, H. (2022). Oral health-related quality of life of conventional removable partial dentures, unilateral nonmetal clasp dentures, and shortened dental arch with 2-or 3-tooth unilateral distal extension tooth loss in the mandible: A randomized, crossover, clinical trial. *The Journal of Prosthetic Dentistry*.
- Nyan, M., Oo, S. Z., Hlaing, E. E., Thin, S. M., Myint, H. K., Win, A., and Tint, K. (2019). A study of relationship between partial edentulism and oral health related quality of life (OHRQoL) and effect of removable partial denture treatment on OHRQoL. *Myanmar Dental Journal* **26**, 41-46.
- Omo, J. O., Sede, M. A., and Esan, T. A. (2016). Quality of life in subjects with shortened

- dental arch rehabilitated with removable metal-based partial dentures. *European Journal of Prosthodontics* **4**, 25.
- Reissmann, D. R., Wolfart, S., John, M. T., Marré, B., Walter, M., Kern, M., Kohal, R., Nothdurft, F., Stark, H., and Schierz, O. (2019). Impact of shortened dental arch on oral health-related quality of life over a period of 10 years—A randomized controlled trial. *Journal of Dentistry* **80**, 55-62.
- Salazar, S., Hori, K., Uehara, F., Okawa, J., Shibata, A., Higashimori, M., Nokubi, T., and Ono, T. (2019). Masticatory performance analysis using photographic image of gummy jelly. *Journal of prosthodontic research* **64**, 48-54.
- Schierz, O., Reissmann, D. R., Rauch, A., John, M. T., Marré, B., Luthardt, R. G., Mundt, T., Hannak, W., Kohal, R., and Kern, M. (2021). Impact of shortened dental arch on oral health-related quality of life. *Journal of Evidence Based Dental Practice* **21**, 101622.
- Silveira, M. F., Pinho, L. d., and Brito, M. F. S. F. (2019). Validity and reliability of the oral health impact profile instrument (OHIP-14) in adolescents. *Paidéia (Ribeirão Preto)* **29**.
- Sugio, C. Y. C., Mosquim, V., Jacomine, J. C., Zabeu, G. S., de Espíndola, G. G., Bonjardim, L. R., Bonfante, E. A., and Wang, L. (2021). Impact of rehabilitation with removable complete or partial dentures on masticatory efficiency and quality of life: A cross-sectional mapping study. *The Journal of prosthetic dentistry*.
- Walter, M. H., Marré, B., Dreyhaupt, J., Heydecke, G., Rauch, A., Mundt, T., Hannak, W., Kohal, R. J., Kern, M., and Nothdurft, F. (2021). Rehabilitation of shortened dental arches: A fifteen-year randomised trial. *Journal of Oral Rehabilitation* **48**, 738-744.
- Yoshimoto, T., Hasegawa, Y., Maria, M. T. S., Marito, P., Salazar, S., Hori, K., and Ono, T. (2023). Effect of mandibular bilateral distal extension denture design on masticatory performance. *Journal of Prosthodontic Research*, JPR_D_22_00135.



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