

Clinical and Functional Rationale for an Individualized Approach to Re-Prosthetic Treatment of Patients with Complete Edentulism of the Mandible

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ABSTRACT

Objective: The aim of the study was to improve the clinical effectiveness of repeat prosthetic treatment through the implementation of a personalized technique for functional shaping of the denture-bearing area, taking into account the morphofunctional characteristics of the tissues. **Method:** The study included 72 patients with complete edentulism of the mandible, 50 of whom sought repeat prosthetic treatment. Two groups were formed: one used conventional dentures with standard custom trays, and the other applied a modified technique with selective functional modeling, involving differentiated pressure and adjustment of denture borders. **Results:** The individualized approach significantly improved denture retention and stability, shortened the adaptation period, and reduced complaints about soreness and prosthesis instability. Functional impression formation with selective modeling led to enhanced clinical outcomes. **Novelty:** The novelty of the study lies in the personalized approach to functional impression formation, which incorporates varied pressure depending on tissue resilience and muscle dynamics, leading to better denture retention and patient satisfaction.

INTRODUCTION

Complete edentulism of the mandible leads to a progressive atrophy of the alveolar ridge, alterations in the mucous membrane, and disruption of neuromuscular balance, which significantly complicate the fabrication of new complete removable dentures. As patients continue to use previously fabricated prostheses for long periods, the dentures may fail to provide adequate retention and proper distribution of masticatory load, leading to difficulties in both function and comfort. This presents a major challenge for dental professionals, as the materials and techniques used for fabricating dentures in edentulous patients need to compensate for these physiological changes in the oral tissues [1], [2]. The long-term consequences of these changes include diminished mucosal resilience and an altered functional load tolerance in the denture-bearing tissues [3], [4].

To address these challenges, the approach to prosthetic treatment must be personalized, taking into account the morphofunctional characteristics of the tissues. Previous studies have suggested the use of denture adhesives, resilient soft liners, and relining of previously fabricated prostheses as potential solutions [5], [6]. However, these methods do not always yield satisfactory results in cases where tissue atrophy is more pronounced, particularly in patients requiring repeat prosthetic treatments [7], [8]. There remains a need for an individualized approach to improve retention, stabilization, and

the overall clinical effectiveness of repeat prosthetic treatments for patients with severe atrophy and altered tissue characteristics [9].

The aim of the current study is to enhance the clinical effectiveness of repeat prosthetic treatment through the application of a personalized technique for functional shaping of the denture-bearing area [10], [11]. The proposed approach involves selective functional modeling with differentiated pressure to account for varying mucosal resilience, while also considering muscle dynamics and tongue position. This method promises to improve the retention and stability of dentures and reduce the adaptation period, providing better long-term outcomes for patients [4], [12]. The study will evaluate these improvements by assessing denture retention, stabilization, and patient satisfaction.

The diagnostic protocol used in this study includes the assessment of alveolar ridge atrophy, mucosal resilience, functional tissue resistance to masticatory load, and the evaluation of swallowing and masticatory functions [13], [14]. These diagnostic measures are critical in determining the appropriateness of prosthetic treatments and ensuring that the treatment approach is aligned with the specific needs of the patient [9]. By integrating these measures into the treatment protocol, this study aims to improve the precision of prosthetic designs and enhance patient satisfaction.

The results of this study will contribute to the growing body of evidence supporting the use of personalized techniques in the field of prosthodontics. It is hoped that the findings will provide clinicians with a more effective approach to managing patients with complete edentulism, offering improved prosthetic outcomes and enhancing the quality of life for these patients [2], [10].

RESEARCH METHOD

This study included 72 patients diagnosed with complete edentulism of the mandible, 50 of whom sought repeat prosthetic treatment [3]. The study participants were divided into two groups. In the first group (n=25), dentures were fabricated according to the conventional clinical protocol, which involved the use of standard custom trays and uniform pressure during functional impression taking. This method was applied in a traditional manner, following established guidelines for patients who are new to prosthetic treatment [5], [11].

In the second group (n=25), a modified technique of selective functional modeling was employed. This technique incorporated differentiated pressure in areas with varying mucosal resilience. Additionally, the denture borders were adjusted considering muscle balance dynamics and tongue position [7], [12]. This personalized approach allowed for a more customized fitting of the dentures, taking into account the individual tissue characteristics of each patient. The aim of this method was to optimize denture retention and stabilization while reducing the adaptation period [4], [13].

The diagnostic protocol included a detailed assessment of the degree of alveolar ridge atrophy, evaluation of mucosal resilience, and functional tissue resistance to

masticatory load [1], [4]. Furthermore, the transverse width of the tongue in the canine projection area was measured, and swallowing and masticatory functions were examined. The salivary flow rate and viscosity were also determined to evaluate the impact of the prosthetic treatment on oral health [8], [14]. These diagnostic measures were essential for analyzing the clinical effectiveness of the dentures and ensuring that each treatment approach was tailored to the specific needs of the patient [9], [15].

RESULT AND DISCUSSION

In complete edentulism, pronounced structural and functional changes develop in the oral tissues. The most significant alterations affect the mandibular alveolar ridge and the mucous membrane forming the denture-bearing area. As the duration of tooth loss increases, bone resorption intensifies, mucosal elasticity decreases, and the muscular balance of the floor of the mouth and tongue changes. As a result, the conditions for orthopedic rehabilitation with complete removable plate dentures progressively deteriorate, especially in patients with prior prosthetic experience.

To improve the effectiveness of repeat prosthetic treatment in clinical practice, various approaches are used, including denture adhesives to enhance retention, resilient soft liners, and relining of previously fabricated prostheses. However, these methods do not always ensure a stable functional outcome in cases of pronounced tissue atrophy. Therefore, the aim of the present study was to refine the clinical methodology of repeat prosthetic treatment in patients with complete edentulism of the mandible.

Results of the Study

Analysis of morphological characteristics showed that in patients undergoing prosthetic treatment for the first time, the first type of mandibular alveolar ridge atrophy was detected significantly more often (30.0%), whereas among patients receiving repeat prosthetic treatment this variant occurred in only 12.0% of cases ($t = 1.96$; $p \leq 0.05$). Conversely, the second type of atrophy significantly predominated in repeat prosthetic patients (46.0%) compared to primary patients (26.7%) ($t = 1.76$; $p \leq 0.05$).

A similar trend was observed in the assessment of the mucous membrane of the denture-bearing area. The first type of atrophy according to Supple's classification was diagnosed more frequently in patients without previous prosthetic experience (62.0% versus 32.0%; $t = 2.47$; $p \leq 0.01$). In contrast, the second type of mucosal atrophy was significantly more common in repeat prosthetic patients (24.0% versus 10.0%; $t = 1.65$; $p \leq 0.05$).

Measurement of mucosal resilience in the projection area of teeth 3.6 and 4.6 on the lingual side showed that in primary prosthetic patients this parameter was 0.54 ± 0.03 mm and 0.53 ± 0.03 mm, respectively. In repeat prosthetic patients, mucosal resilience was significantly lower: 0.36 ± 0.03 mm and 0.37 ± 0.03 mm ($t = 4.38$; $p \leq 0.001$ and $t = 4.34$; $p \leq 0.001$). At the same time, increased resistance of the mucosa to mechanical load was noted in repeat prosthetic patients. Their tissues tolerated loads up to 6.6 ± 0.5 N,

which was almost twice the corresponding value in patients undergoing primary prosthetic treatment.

Assessment of tongue dimensions revealed that its width in the area of missing teeth 3.3 and 4.3 in patients without previous prosthetic treatment was 35.2 ± 1.2 mm. In repeat prosthetic patients, this parameter was significantly higher – 38.3 ± 1.0 mm ($t = 1.99$; $p \leq 0.05$). The increased tongue width combined with greater mucosal resistance to loading served as the basis for developing a technique of localized differentiated functional impression.

The proposed approach involves reducing the denture base area of the mandibular prosthesis and purposefully redistributing pressure, including more pronounced compression of tissues in the sublingual region. While in primary prosthetic patients the denture base area was 25.11 ± 1.25 cm², in repeat prosthetic patients it was reduced to 18.30 ± 2.89 cm², which is 1.4 times smaller ($t = 2.35$; $p < 0.05$). The pressure applied during functional impression taking ranged from 2 to 8 N depending on the individual tolerance of the mucosa to mechanical loading.

Clinical evaluation demonstrated that when using the method of localized differentiated functional impression, the level of denture retention and stabilization reached 1.36 ± 0.23 points.

In the group of patients who underwent repeat prosthetic treatment using the conventional method, this показатель was significantly worse, reaching 2.12 ± 0.24 points ($t = 2.23$; $p < 0.05$).

Dynamic follow-up confirmed the stability of the obtained results. Functional parameters were assessed on days 2, 7, 14, 30, 60, 90, and 180 after denture insertion, which made it possible to monitor patient adaptation and confirm the advantage of the proposed technique in repeat mandibular prosthetic treatment.

Analysis of functional adaptation revealed differences in the timing of recovery of the main indicators between the groups.

In patients undergoing prosthetic treatment for the first time, the most pronounced positive changes were observed in the restoration of the swallowing act. Improvement in this parameter occurred earlier than in other functions. An increase in masticatory efficiency in this category of patients was recorded as early as day 14 of denture use, indicating gradual neuromuscular adaptation to the new orthopedic construction.

In patients who underwent repeat prosthetic treatment using the traditional method, restoration of swallowing function was observed by the end of the second week. By day 30, a significant increase in masticatory efficiency was noted – from $42.48 \pm 1.18\%$ to $46.48 \pm 1.15\%$ ($t = 2.43$; $p < 0.05$) – along with a reduction in chewing time from 40.84 ± 1.25 s to 37.68 ± 0.88 s ($t = 2.07$; $p < 0.05$).

In the group where the improved technique was applied, positive dynamics appeared earlier and were more pronounced. As early as day 14, a significant reduction in chewing time was recorded – from 38.88 ± 0.88 s to 36.12 ± 0.42 s ($t = 2.82$; $p < 0.01$),

while masticatory efficiency increased from $48.24 \pm 0.78\%$ to $52.52 \pm 0.83\%$ ($t = 3.74$; $p < 0.001$). Improvement in swallowing indicators became statistically significant by day 30: the amount of unchewed food substrate decreased from 752.00 ± 88.28 mg to 412.00 ± 50.89 mg ($t = 3.34$; $p < 0.01$).

Comparative analysis showed that in repeat prosthetic patients, restoration of swallowing function began as early as day 7 ($t = 2.12$; $p < 0.05$). When comparing adaptation dynamics between the traditional and improved treatment groups, it was established that in patients treated using the modified technique, chewing and swallowing functions were already significantly better on day 2 of denture use ($t = 4.07$; $p < 0.001$ and $t = 2.33$; $p < 0.05$, respectively).

Throughout the entire observation period, masticatory efficiency in patients treated with the improved technique remained at a higher level – $54.92 \pm 0.73\%$ versus $51.54 \pm 1.04\%$ in the standard prosthetic group ($t = 2.65$; $p < 0.05$). At the same time, the duration of the chewing cycle was significantly shorter – 32.28 ± 0.62 s compared to 34.38 ± 0.38 s ($t = 2.87$; $p < 0.01$).

Changes in salivation also demonstrated different dynamics. In patients undergoing primary prosthetic treatment, after a short-term increase in secretion on day 2 (0.66 ± 0.07 ml/min), normalization occurred only by day 60 (0.46 ± 0.03 ml/min; $t = 3.68$; $p < 0.01$). An increase in saliva viscosity – from 2.15 ± 0.13 to 2.75 ± 0.14 conventional units ($t = 3.14$; $p < 0.01$) – was observed only after three months.

In the group undergoing repeat prosthetic treatment using the conventional method, salivary flow rate stabilized by the end of the second week (from 0.65 ± 0.03 to 0.48 ± 0.03 ml/min; $t = 3.80$; $p < 0.001$), while saliva viscosity normalized by the second month (from 2.22 ± 0.15 to 2.75 ± 0.18 conventional units; $t = 2.20$; $p < 0.05$).

With the improved technique, normalization of salivary secretion occurred earlier – by day 14 (from 0.54 ± 0.03 to 0.46 ± 0.02 ml/min; $t = 2.60$; $p < 0.05$). An increase in saliva viscosity was observed by the second month of follow-up – from 2.91 ± 0.12 to 3.45 ± 0.15 conventional units ($t = 2.78$; $p < 0.05$), indicating faster functional adaptation of the salivary glands and oral tissues to the new dentures.

Comparative analysis showed that in patients receiving repeat prosthetic treatment, normalization of salivary function occurred faster than in those receiving dentures for the first time, with recovery observed as early as day 7 ($t = 2.24$; $p < 0.05$).

Assessment of adaptation dynamics within the repeat prosthetic groups revealed statistically significant differences between the standard and improved methods. In patients whose dentures were fabricated with a reduced base using the modified technique, salivation rate was already significantly lower on day 2 compared to the conventional treatment group ($t = 2.36$; $p < 0.05$), while saliva viscosity was, in contrast, higher ($t = 3.50$; $p < 0.01$).

These findings are likely due to the reduced denture base volume. A more compact prosthesis exerts less mechanical and reflexive impact on the mucosa of the denture-bearing area, which decreases irritation of the receptor apparatus and reduces

compensatory hypersecretion of salivary glands in response to the presence of a foreign body.

Synthesis of the clinical and functional indicators demonstrated that repeat prosthetic patients exhibit characteristic morphological features: increased transverse tongue size, more pronounced atrophy of the denture-bearing tissues, predominance of the second type of mandibular alveolar ridge atrophy according to Keller, and decreased mucosal resilience accompanied by approximately twofold increased functional resistance to load.

These features create the basis for applying gentle, bilateral, and controlled pressure in the sublingual region during functional impression taking. Implementation of this approach improves the retention and stabilization of complete removable plate dentures by approximately 1.5 times and contributes to a reduction in the adaptation period for patients to the new prosthetic constructions.

CONCLUSION

Fundamental Finding : The study found that in patients with repeat prosthetic treatment, the use of a modified technique involving differentiated pressure on varying mucosal resilience and adjusted denture borders resulted in significantly improved denture retention and stability. This approach also shortened the adaptation period and reduced complaints of soreness and instability. In contrast, conventional techniques using standard custom trays with uniform pressure during functional impression taking showed less effective results in terms of retention and stabilization. Additionally, patients treated with the individualized technique experienced earlier and more pronounced positive changes in masticatory efficiency and swallowing function compared to those treated with conventional methods. **Implication :** The findings suggest that a personalized approach to functional impression formation, based on individual tissue characteristics and functional modeling, can significantly enhance the effectiveness of repeat prosthetic treatments. This method can be integrated into clinical practice to improve patient satisfaction by reducing the adaptation period and improving overall denture stability. The approach also emphasizes the importance of individualized care in the field of prosthodontics, highlighting how tailored treatments can address the unique challenges posed by severe atrophy and altered mucosal resilience in edentulous patients. **Limitation :** The study is limited by the relatively small sample size, with only 50 patients seeking repeat prosthetic treatment. While the results demonstrate improvements in denture retention and stabilization, further research with a larger and more diverse sample is needed to confirm the generalizability of the findings. Additionally, the study focused only on mandibular prosthetics, and the applicability of the personalized technique to maxillary edentulism remains unaddressed. Long-term follow-up studies are also needed to assess the durability of the improvements observed. **Future Research :** Future research could explore the application of the personalized technique in patients with maxillary edentulism to evaluate its effectiveness in the upper

jaw. Further studies should include a larger sample size and consider long-term follow-up to assess the sustained benefits of this approach. Additionally, research into the impact of this technique on different age groups and in patients with varying degrees of atrophy and mucosal resilience could provide deeper insights into its versatility. Investigating the cost-effectiveness of the personalized approach compared to conventional methods could also be beneficial in determining its feasibility for broader implementation in clinical settings.

REFERENCES

- [1] K. N. Shurygin, R. S. Matveev, and B. N. Khanbikov, "Adaptation problems to removable dentures in patients of different age groups," *Acta Medica Eurasica*, vol. 2, pp. 56–63, 2023.
- [2] S. N. Razumova, A. S. Brago, and others, "Microbiota of complete removable dentures and its clinical significance," *Russian Journal of Dentistry*, vol. 28, no. 3, pp. XXX–XXX, 2024.
- [3] Y. Feng, J. Li, X. Zhang, and others, "Expert consensus on digital restoration of complete dentures," *Int J Oral Sci*, vol. 17, 2025.
- [4] O. A. Shulyatnikova, M. V. Yakovlev, and A. P. Godovalov, "Analysis of causes of repeated prosthodontic treatment in patients with complete edentulism," *Rossiyskiy Stomatologicheskiy Zhurnal*, vol. 28, no. 2, pp. 34–40, 2024.
- [5] A. S. Bidra, J. R. Agar, and others, "Complete denture prosthodontics: contemporary clinical protocols and outcomes," *J Esthet Restor Dent*, vol. 36, no. 1, pp. 85–97, 2024.
- [6] H. Y. Duong, A. Rocuzzo, A. Stähli, and others, "Oral health-related quality of life of patients rehabilitated with fixed and removable implant-supported prostheses," *Periodontol 2000*, vol. 88, no. 1, pp. 169–188, 2022.
- [7] A. Casucci, "Digital vs conventional removable complete dentures: clinical and cost-efficiency comparison," *J Prosthet Dent*, vol. 133, no. 2, pp. XXX–XXX, 2025.
- [8] M. Martin-Ares, C. Barona-Dorado, B. Guisado-Moya, and others, "Long-term outcomes of prosthetic rehabilitation in completely edentulous patients," *Clin Oral Implants Res*, vol. 34, no. Suppl 29, pp. 120–130, 2023.
- [9] A. Bors, D. Popa, A. Mesaros, and others, "Patient satisfaction and perception with digital complete dentures," *Int J Prosthodont*, vol. 38, no. 1, pp. XX–XX, 2025.
- [10] W. A. Clark, "Treatment of the completely edentulous patient with complete dentures: current perspectives," *Dent Clin North Am*, vol. 69, no. 1, pp. 1–18, 2025.
- [11] A. V. Guskov, "Comparative evaluation of masticatory efficiency of different removable prosthetic constructions," *Nauka Molodezhi*, vol. 4, pp. 78–84, 2024.
- [12] Y. I. Bayramov, "Comparative evaluation of functional efficiency of complete removable laminar dentures," *Azerbaijan Medical Journal*, vol. 3, pp. 45–52, 2023.
- [13] S. Iacob, R. M. Chisnoiu, A. Zaharia, and others, "Clinical evaluation of digital versus conventional impression in edentulous patients with flabby ridges," *BMC Oral Health*, vol. 25, 2025.
- [14] L. I. Nikitina and A. S. Gromova, "Stomatologicheskaya rehabilitatsiya patsientov s polnoy adentivoy s ispolzovaniyem implantatov," *Acta Medica Eurasica*, vol. 3, pp. 22–29, 2022.
- [15] Z. N. Al-Dwairi, C. D. Lynch, and others, "Management of severely resorbed mandibular ridges in complete denture patients," *J Prosthodont*, vol. 32, no. 6, pp. 512–519, 2023.

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