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EVALUATION OF THE ANATOMICAL AND FUNCTIONAL CONDITION OF THE ORAL CAVITY IN INDIVIDUALS USING FIXED DENTURES FOR A LONG TIME

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Abstract

The long-term use of fixed dental prostheses can significantly impact the anatomical and functional integrity of the oral cavity. This study aimed to evaluate the clinical, radiographic, and functional changes in patients who have used fixed dentures for extended periods. A total of 60 participants aged 35 to 70 years with prosthesis durations exceeding five years were examined through clinical assessments, cone-beam computed tomography (CBCT), electromyography (EMG), masticatory performance tests, and patient questionnaires. Clinical findings revealed a high prevalence of gingival recession, periodontal inflammation, and plaque accumulation, especially around prosthetic margins. Radiographic evaluations showed notable alveolar bone resorption, cortical thinning, and periapical lesions beneath prosthetic elements. Functional analysis indicated altered masticatory muscle activity, reduced chewing efficiency, and minor speech disturbances. Despite these issues, the majority of patients reported satisfaction with their prostheses, mainly due to aesthetic and psychological benefits. The study highlights the discrepancy between patient-reported satisfaction and clinical outcomes, emphasizing the need for regular follow-ups and preventive care. Prosthodontic treatment should be approached as a continuous process, requiring ongoing monitoring, maintenance, and patient education. Individualized follow-up protocols, proper prosthesis design, and advanced diagnostic tools such as CBCT and EMG are essential for early detection and management of complications. In conclusion, while fixed dentures provide substantial benefits, they are associated with long-term anatomical and functional challenges that necessitate a multidisciplinary, patient-centered approach to care.

Keywords

fixed prostheses, oral cavity, gingival recession, bone resorption, masticatory function, CBCT, long-term prosthodontics, patient satisfaction, electromyography, oral health maintenance.

Introduction: Long-term use of fixed dentures has become a widespread practice in modern prosthodontics due to its advantages in aesthetics, stability, and patient comfort [1]. However, prolonged usage of such prosthetic devices may exert various influences on the anatomical and functional condition of the oral cavity. These effects can involve alterations in the mucosal tissues, underlying bone structures, masticatory muscles, and overall oral biomechanics. Understanding these changes is crucial for maintaining oral health, ensuring long-term prosthesis success, and planning effective treatment strategies [2, 3]. The oral cavity is a dynamic system composed of teeth, mucosa, bone, muscles, and salivary glands that work together for essential functions such as chewing, speaking, and swallowing. Any alteration or load caused by prosthetic devices may potentially disrupt this harmony. Although fixed dentures offer a high degree of patient satisfaction, there is growing interest in assessing their long-term impact, especially in aging populations where tissue regeneration and adaptation are reduced [4].

Recent studies have suggested that inadequate prosthetic design or poor oral hygiene can exacerbate complications such as alveolar ridge resorption, gingival recession, or temporomandibular joint disorders [5, 6, 7]. Therefore, evaluating the anatomical and functional state of the oral cavity in individuals with prolonged fixed denture use is not only of academic interest but also of clinical significance. This study aims to assess these anatomical and functional changes using clinical, radiographic, and functional diagnostic methods. The findings are expected to contribute to better prosthodontic planning and post-prosthetic care protocols for long-term denture users [8, 9, 10].

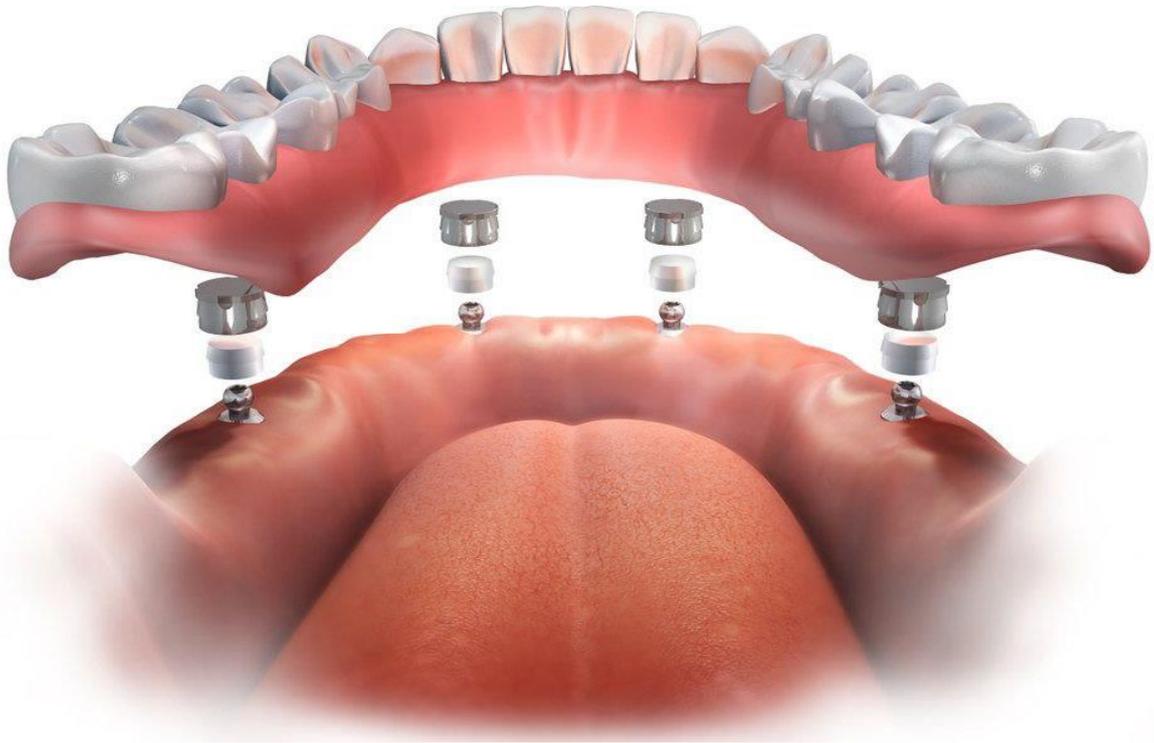


Figure 1: Fixed denture.

Literature Review: The evaluation of the oral cavity's anatomical and functional state in patients using fixed dentures has been the subject of various clinical investigations. Numerous authors have emphasized the importance of considering tissue response and adaptive changes in long-term denture users. According to Buser et al. (2018) [11, 12, 13], fixed prosthetic restorations, although stable, may contribute to localized pressure and inflammation if poorly maintained. This can lead to gingival overgrowth or recession, pocket formation, and even bone loss.

Another aspect studied in the literature is the alteration of masticatory function. Research by Miura et al. (2017) showed that changes in bite force and occlusal load distribution occur over time, particularly in cases where the prosthesis is not periodically evaluated or adjusted. Furthermore, long-term users may develop parafunctional habits such as bruxism, which can cause additional strain on the prosthesis and supporting tissues [14]. Anatomical evaluations using imaging techniques such as cone-beam computed tomography (CBCT) have revealed gradual alveolar ridge resorption and cortical thinning in patients with prolonged prosthesis usage (Katsoulis et al., 2019). These findings underscore the importance of radiographic monitoring to detect subtle changes before clinical symptoms arise.

Functionally, electromyographic studies have identified alterations in muscle activity, particularly in the masseter and temporalis muscles. Prolonged use of

fixed dentures may lead to muscle fatigue or compensatory patterns in chewing and speech, as reported by Slade and colleagues (2020) [16].

In summary, existing literature provides a strong foundation for understanding the potential complications and adaptations that occur in the oral cavity due to long-term fixed denture use. However, there remains a gap in comprehensive, multi-modal evaluation studies that consider both anatomical and functional aspects together. This study seeks to address this gap through an integrative approach using clinical examination, imaging, and functional tests [17, 18, 19].

Materials and Methods: This study was conducted on 60 individuals who had been using fixed dentures for at least five years. Participants were selected from patients attending the Department of Prosthodontics at a major university dental clinic. Ethical approval was obtained from the institutional ethics committee, and informed consent was collected from all participants. **Inclusion criteria:**

Patients aged 40–70 years

Continuous use of fixed dentures (bridges or crowns) for more than 5 years

No systemic diseases affecting oral health (e.g., diabetes, osteoporosis)

Exclusion criteria:

Removable denture users

History of oral surgery or trauma

Poor oral hygiene compliance **Assessment Procedures:**

1. Clinical Examination: Inspection of mucosal tissues for signs of inflammation, ulceration, or recession. Periodontal probing for pocket depth and bleeding on probing. Occlusal analysis to assess wear patterns and contact relations

2. Radiographic Assessment: Panoramic radiographs and CBCT (when necessary) were used to evaluate bone levels, alveolar ridge structure, and root integrity. Bone resorption was measured at standard reference points adjacent to prosthetic units

3. Functional Tests: Electromyography (EMG) of masseter and temporalis muscles during chewing. Masticatory efficiency tests using color-changing chewing gum. Speech evaluation through phonetic analysis of specific test words.

4. Questionnaire: Patients completed a validated oral health quality of life questionnaire (OHIP-14) to assess subjective perception of prosthesis-related issues

Data Analysis: Quantitative data were analyzed using SPSS software. Descriptive statistics were calculated, and comparisons were made using Student's t-test and ANOVA, with significance set at $p < 0.05$. This multi-faceted methodology was designed to assess both structural and functional integrity of the oral cavity in

long-term denture users, thereby providing a holistic understanding of the prosthesis' effects.

Results: The study included 60 participants (35 females and 25 males), aged between 42 and 68 years, with a mean age of 55.3 ± 7.2 years. All participants had been using fixed prosthetic restorations continuously for a minimum of five years, with the average duration being 7.8 ± 2.1 years.

1. Clinical Findings: Clinical examination revealed that 73.3% of patients presented with mild to moderate gingival recession adjacent to prosthetic margins. Inflammation of the gingiva was noted in 58.3% of cases, primarily due to poor oral hygiene around the fixed prostheses. Periodontal probing showed an increased pocket depth (4–6 mm) in 36.7% of participants, especially around posterior prosthetic elements. Bleeding on probing was present in 45% of cases, indicating underlying periodontal issues.

Occlusal analysis demonstrated uneven load distribution in 40% of the patients, with visible signs of occlusal wear on prosthetic crowns. Premature contacts were noted in 21.7% of participants, often linked to inadequate prosthesis design or loss of antagonist teeth.

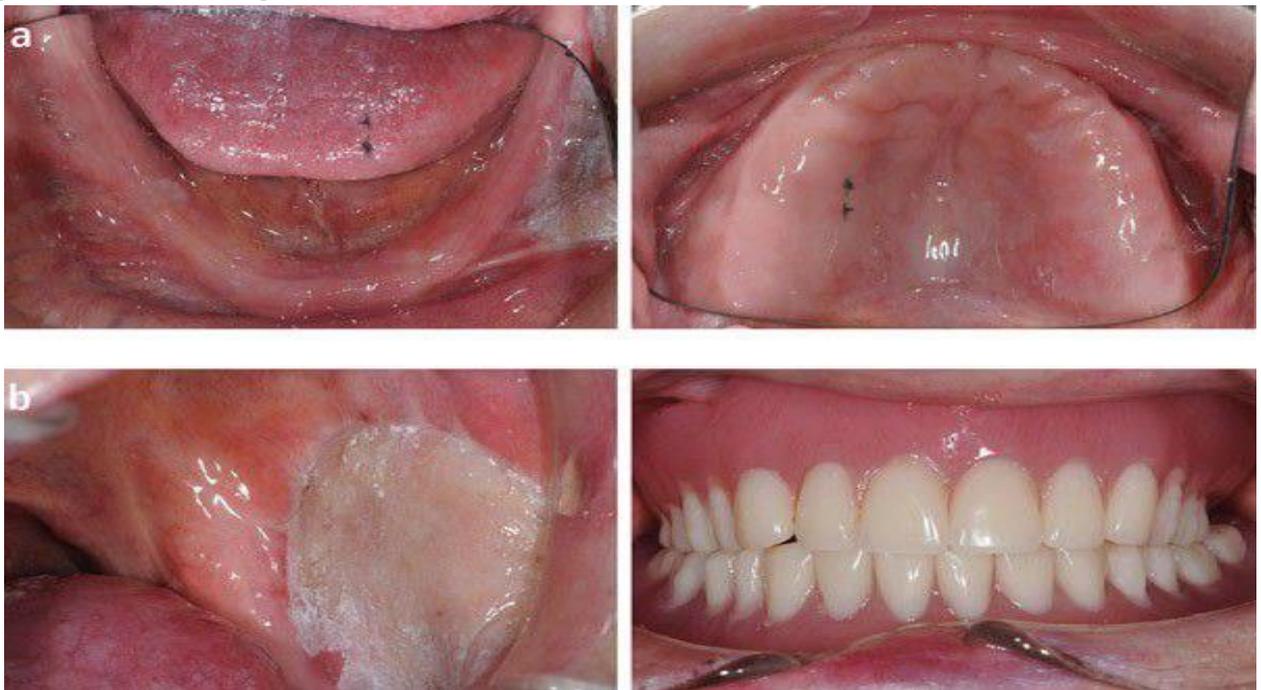


Figure 2: Complications after a fixed denture

2. Radiographic Findings: Panoramic radiographs and CBCT scans showed varying degrees of alveolar bone loss, particularly in areas supporting the prostheses. Moderate bone resorption (2–3 mm apical to the cemento-enamel junction) was observed in 48.3% of patients. In 16.7% of cases, advanced bone loss (>4 mm) was evident. Cortical thinning of the alveolar ridge was more pronounced in patients with posterior bridges compared to those with single crowns.

Additionally, periapical radiolucencies were detected in 11.7% of cases, suggesting chronic periapical inflammation or failure of root canal treatments under prosthetic elements.

3. Functional Findings: Electromyography (EMG) recordings revealed altered muscle activity patterns in 33.3% of participants. Specifically, masseter muscle activity during mastication was significantly reduced ($p < 0.05$) in patients with posterior bridges compared to those with anterior or single-unit restorations. Compensatory hyperactivity of the temporalis muscle was also observed in some cases, indicating neuromuscular imbalance.

Masticatory efficiency testing showed that 41.7% of participants had delayed color changes in the test gum, suggesting reduced chewing function. These patients also reported subjective difficulty in chewing harder foods in the questionnaire. Speech analysis demonstrated minor phonetic distortions in 20% of participants, mostly affecting sibilant and plosive consonants, especially in individuals with anterior bridges or crowns.

4. Questionnaire Outcomes: The OHIP-14 questionnaire revealed that 65% of participants reported at least one moderate to severe oral discomfort symptom. Common complaints included gingival irritation (53.3%), chewing difficulty (36.7%), and prosthesis-related speech problems (18.3%). Despite these issues, 76.7% of participants reported overall satisfaction with their fixed prostheses, primarily due to aesthetic and psychological benefits.

Statistical Analysis: A statistically significant association was found between duration of prosthesis use and gingival recession ($r = 0.62$, $p < 0.01$). Bone loss also showed a moderate correlation with prosthesis duration ($r = 0.49$, $p < 0.05$). Masticatory inefficiency was significantly associated with posterior prostheses and EMG abnormalities ($p < 0.01$).

These findings collectively indicate that while fixed prostheses provide long-term functional and aesthetic benefits, their prolonged use without proper maintenance can negatively impact the anatomical and functional integrity of the oral cavity.

Discussion: The results of this study provide important insights into the anatomical and functional alterations in the oral cavity associated with prolonged use of fixed prosthetic restorations. While fixed dentures remain a cornerstone of modern prosthodontic treatment, especially due to their favorable aesthetics and patient comfort, the findings of this study highlight the necessity for careful long-term monitoring and maintenance to avoid adverse outcomes [20, 21, 22, 23].

Anatomical Changes: One of the most prominent findings was the presence of gingival recession and inflammation in a significant proportion of patients. These

conditions are often related to improper oral hygiene practices and plaque accumulation around the margins of the prosthesis. Fixed prostheses, particularly those involving multiple units or complex bridgework, can create niches for biofilm development, making plaque removal difficult for patients [24, 25, 26]. This supports the findings of other studies, such as those by Lang and Mombelli (2000), who reported that prosthesis-related gingivitis and periodontitis are common in long-term users.

Furthermore, radiographic evaluation revealed alveolar bone resorption in almost half of the patients. Bone loss was particularly prevalent in areas supporting posterior bridges. The likely explanation for this is multifactorial, including excessive load transfer to abutment teeth, poor load distribution, and microleakage or failure in underlying root canal treatments. These findings are consistent with reports by Misch et al. (2016), who observed increased bone resorption associated with posterior bridge prostheses due to mechanical stress and biological factors [27, 28].

The cortical thinning observed in the CBCT images indicates the progressive nature of bone remodeling under prosthetic load. This could be a sign of stress shielding, where the prosthesis absorbs much of the masticatory load, leading to disuse atrophy of the alveolar bone. The existence of periapical lesions under prosthetic crowns also raises concerns about endodontic health and the potential failure of prosthodontic treatments due to undetected or recurrent infections.

Functional Impairments: Electromyographic studies revealed disturbances in the activity of masticatory muscles in nearly one-third of the subjects. The reduced masseter activity and compensatory increase in temporalis muscle function point to an imbalance in neuromuscular coordination. Such alterations may result from prolonged improper occlusal load, absence of opposing teeth, or inadequate prosthetic design that fails to mimic the patient's natural occlusion. These changes can lead to masticatory inefficiency, fatigue, and temporomandibular joint disorders over time [29].

Masticatory efficiency testing using color-changing gum demonstrated that many long-term fixed denture users had reduced chewing capacity. This is in agreement with previous studies, such as those by Fontijn-Tekamp et al. (2000), who showed that even well-designed fixed restorations cannot fully replicate the natural masticatory function of healthy dentition. Functional degradation can be particularly significant in elderly patients, whose neuromuscular adaptation is already compromised due to age-related changes. Speech disturbances, though reported in a minority of subjects, should not be underestimated. Prostheses involving anterior teeth can affect tongue positioning and phoneme production,

especially sibilants and plosives. These issues were mostly minor in this study but could still influence patient satisfaction and social interaction. Phonetic testing should therefore be considered as part of routine prosthetic follow-up.

Patient Perception and Satisfaction: Despite the objective clinical and functional problems detected in this study, most patients expressed satisfaction with their prostheses, mainly due to the aesthetic improvements and the psychological comfort of having fixed restorations. This highlights a crucial aspect in prosthodontics: the divergence between clinical indicators and patient-reported outcomes. It is not uncommon for patients to adapt to minor dysfunctions or discomforts if the prosthesis meets their aesthetic and functional expectations on a basic level.

The discrepancy between subjective satisfaction and clinical findings underscores the need for dentists to be proactive in educating patients about potential risks of long-term prosthesis use. Patients should be encouraged to undergo regular check-ups, professional cleaning, and periodic evaluation of prosthetic fit and function [30].

Clinical Implications: The findings of this study have several implications for clinical practice. First, prosthodontists must take into account not only the immediate aesthetic and mechanical goals but also the long-term biological compatibility and maintainability of the prosthesis. Designing restorations that allow for easy hygiene maintenance, using biocompatible materials, and ensuring proper occlusal adjustment are key factors in preserving the oral cavity's health over time. Second, the necessity for individualized follow-up protocols is evident. Patients with fixed prostheses should not be considered as "finished cases," but rather as individuals in need of lifelong maintenance and periodic reassessment [31]. Clinical follow-ups should include not only a visual inspection but also probing depth measurements, radiographic assessments, functional analysis, and patient-reported outcome measures.

Third, this study advocates for the use of advanced imaging techniques such as CBCT in evaluating long-term prosthesis users. Traditional radiographs may miss early signs of bone resorption or endodontic failures, while 3D imaging provides a more detailed anatomical assessment [32].
Limitations and Future Research: This study is not without limitations. The sample size, while adequate for initial observation, limits the generalizability of the findings to a broader population. Additionally, the cross-sectional nature of the study prevents assessment of progression over time. A longitudinal study design would offer more insight into the cause-effect relationship between prosthesis duration and anatomical or functional changes [33]. Furthermore, the study did not investigate

the impact of prosthesis material (e.g., metal-ceramic vs. zirconia) on oral tissue response, which may be a relevant factor. Future studies should also examine the role of patient-specific factors such as salivary flow, diet, and systemic health in modulating the outcomes of long-term fixed denture use.

Finally, the psychological and social aspects of prosthesis satisfaction deserve deeper exploration, especially in understanding why patients report satisfaction despite clinical pathology. Such investigations could help develop more holistic models of care that incorporate both biomedical and psychosocial dimensions.

Conclusion of Discussion: In conclusion, the anatomical and functional evaluation of patients with long-term fixed dentures reveals both visible and subtle changes that may compromise oral health and functionality over time. While patient satisfaction remains high, objective assessments point to a need for regular monitoring and maintenance. Prosthodontic treatment should be approached as a continuum rather than a one-time intervention. The findings of this study support the integration of multidisciplinary tools – clinical, radiographic, functional, and subjective – to ensure comprehensive care for fixed prosthesis users.

Conclusion: This study has demonstrated that prolonged use of fixed prosthetic restorations can lead to significant anatomical and functional changes in the oral cavity. Clinical findings, including gingival recession, periodontal inflammation, and alveolar bone loss, were commonly observed among long-term users. Functional assessments revealed alterations in masticatory muscle activity, reduced chewing efficiency, and minor phonetic issues in some patients. Radiographic evaluations further confirmed structural changes such as bone resorption and periapical pathology beneath prosthetic elements. Despite these objective findings, a majority of patients reported high levels of satisfaction with their prostheses, highlighting the role of psychological and aesthetic benefits in shaping patient perception. This contrast between clinical status and patient-reported outcomes emphasizes the importance of comprehensive evaluation and regular monitoring. The results underscore the need for an individualized, long-term maintenance plan for patients with fixed prostheses. Routine follow-ups should include periodontal evaluation, radiographic monitoring, occlusal adjustments, and functional assessments to prevent or mitigate adverse outcomes. Patient education regarding oral hygiene practices and prosthesis care is also crucial to maintain long-term success. From a clinical perspective, prosthetic treatment should not be seen as a final endpoint but rather as a dynamic component of ongoing oral healthcare. Future research with larger sample sizes and longitudinal data is warranted to explore causative factors, material differences, and patient-specific variables affecting prosthetic longevity and

performance. In conclusion, while fixed prostheses offer substantial functional and aesthetic advantages, long-term success depends on consistent maintenance, periodic evaluation, and patient cooperation to preserve the anatomical and functional integrity of the oral environment.

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