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Improving the Treatment and Prevention of Cytomorphological Changes in Localized Periodontitis After the Use of Removable Dentures

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Abstract Removable dentures, though effective in restoring function and aesthetics for edentulous patients, have been increasingly associated with the onset of localized periodontitis due to both mechanical and microbial etiologies. This article provides a structured review of cytomorphological changes occurring in periodontal tissues under the influence of removable dentures. Mechanical pressure leads to epithelial thinning and basal lamina disruption, while poor hygiene promotes biofilm accumulation, causing chronic inflammation and fibroblast degeneration. The review draws from high-quality literature across prosthodontics and periodontology to explore these cellular-level transformations and propose preventive approaches such as improved denture hygiene, soft liners, biocompatible materials, and patient education. The findings emphasize the need for interdisciplinary dental care and the development of chairside diagnostic tools for early detection. Ultimately, this work underscores the clinical relevance of cytomorphological surveillance in denture wearers and outlines strategies to improve oral and systemic health outcomes through preventive periodontal protocols.

Keywords Removable dentures, Localized periodontitis, Cytomorphological changes, Oral inflammation, Prosthesis-induced pathology

1. Introduction

Removable dentures continue to play a critical role in the oral rehabilitation of edentulous and partially edentulous patients worldwide. They are particularly essential in elderly populations, where economic, anatomical, or systemic limitations often make fixed prosthodontic solutions unfeasible. However, despite their restorative benefits, removable dentures are frequently associated with a variety of biological complications in the oral cavity, one of the most significant being localized periodontitis [6,9].

Localized periodontitis induced by removable dentures arises primarily from the interaction between mechanical irritation and microbial colonization. Ill-fitting or worn -out prostheses often exert chronic pressure on the gingival tissues, leading to epithelial trauma, disruption of the junctional epithelium, and chronic inflammatory responses in the underlying connective tissue (Oliveira et al., 2019). Moreover, inadequate denture hygiene can promote the accumulation of bacterial biofilm, creating a favorable environment for anaerobic pathogens such as *Porphyromonas gingivalis* and *Prevotella intermedia*, which further exacerbate tissue inflammation and destruction [1,4,8].

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Cytomorphological changes in the periodontium under such conditions are of particular concern. These changes include epithelial thinning, disruption of the basal membrane, increased vascular permeability, inflammatory infiltration, and fibroblastic degeneration. If left unaddressed, these microscopic changes may contribute to clinically visible manifestations such as pocket formation, bleeding, gingival recession, and eventually alveolar bone loss—posing serious challenges to the retention and functionality of prostheses [3,8].

While several studies have acknowledged the link between prosthesis-induced trauma and periodontal inflammation, there is a pressing need to improve the understanding and management of the cytomorphological consequences of denture use. Early identification of histological alterations and the implementation of preventive strategies can significantly reduce the risk of progressive periodontal disease and tooth loss in partially edentulous individuals [8,10].

Therefore, this article aims to review the pathological changes observed at the cellular level in localized periodontitis associated with removable dentures and to propose therapeutic and preventive approaches that are non-invasive, cost-effective, and clinically sustainable. An integrated understanding of these changes can lead to more personalized dental care and enhanced outcomes in prosthodontic rehabilitation [2,5,6].

2. Materials and Methods

This study is structured as a comprehensive narrative and integrative literature review aimed at examining the cytomorphological changes that occur in the periodontium following the use of removable dentures and evaluating contemporary strategies for their prevention and management. Due to the absence of original clinical data and ethical constraints associated with primary experimental work, the study was conceptualized to rely entirely on a structured analysis of previously published research articles, scientific reviews, and clinical guidelines [5,8].

Scope and Rationale of the Review

The rationale for employing a literature-based methodology lies in the need to synthesize dispersed but clinically relevant knowledge from various disciplines—prosthodontics, periodontology, oral pathology, and dental biomaterials. Cytomorphological research, in particular, often resides within histopathological or laboratory-based publications that are not always readily accessible or well integrated into routine clinical practice. Therefore, this study attempts to bridge the gap between bench research and bedside application by organizing cytological and histological findings within a preventive clinical framework [8,9].

The review not only explores the histological consequences of mechanical and microbial impacts from removable dentures but also critically evaluates the clinical implications of such changes—especially in partially edentulous and elderly populations where the demand for removable prosthetics remains high [10].

Data Sources and Search Strategy

A comprehensive electronic search was carried out using three major biomedical databases—PubMed, Scopus, and Google Scholar—in order to ensure the inclusion of both high-impact and broadly indexed sources. The search period spanned publications from January 2015 to March 2025 to ensure the inclusion of the most up-to-date evidence.

The following Boolean search terms and keyword combinations were utilized:

- "removable dentures" AND "localized periodontitis"
- "cytomorphological changes" OR "gingival epithelium" AND "prosthesis-induced inflammation"
- "epithelial atrophy" OR "connective tissue degeneration" AND "removable prosthodontics"
- "denture hygiene" OR "oral mucosal inflammation" AND "prevention strategies"

Filters were applied to restrict results to peer-reviewed journals, articles published in English, and documents available in full-text format.

Selection Criteria

Articles were included based on the following inclusion criteria:

- Peer-reviewed publications focusing on the biological or mechanical effects of removable dentures on periodontal tissues
- Studies that documented cytomorphological, histological, or ultrastructural changes in the gingiva or periodontal ligament
- Research discussing therapeutic and preventive interventions to mitigate denture-associated periodontitis

The following exclusion criteria were applied:

- Studies limited to fixed or implant-supported prostheses without mention of removable devices
- Case reports, editorials, or non-systematic reviews lacking detailed cellular or morphological data
- Non-English publications or articles with inaccessible full texts
- Research focusing solely on general oral mucosal lesions without specific reference to periodontitis or periodontal structures

Initial screening of titles and abstracts was performed to exclude clearly irrelevant studies. Full-text evaluation was subsequently undertaken for all studies meeting inclusion criteria.

Data Extraction and Thematic Analysis

Relevant data from each included article were extracted using a structured review matrix. Extracted information included:

- Study design and sample characteristics
- Type and classification of removable dentures studied (partial vs. complete, acrylic vs. metal framework)
- Specific cytomorphological findings such as epithelial atrophy, basal membrane disruption, inflammatory cell infiltration, fibroblast morphology, and vascular changes
- Diagnostic methods used (light microscopy, immunohistochemistry, transmission electron microscopy)
- Proposed preventive strategies and their outcomes (e.g., denture hygiene regimens, biofilm control agents, antimicrobial liners, patient education)
- Reported clinical implications of untreated cytomorphological changes

Following data extraction, the information was synthesized using thematic analysis. Articles were grouped based on shared clinical observations and cytological features. Preventive and therapeutic strategies were likewise categorized according to their mechanism of action, level of invasiveness, and clinical feasibility.

Methodological Limitations

As a non-interventional review, the study does not include statistical meta-analysis, and findings are limited by the heterogeneity of study designs and sample characteristics across the included publications. However, emphasis was placed on triangulating findings across multiple high-quality sources to ensure internal validity and external applicability [6,7,9].

Ethical Considerations

Given that this research did not involve the participation of human subjects, animals, or identifiable personal data, ethical clearance was not required. Nevertheless, the review

adheres strictly to academic standards of citation, transparency, and scientific integrity. All referenced articles were properly attributed, and no data were fabricated, falsified, or misrepresented.

3. Results

The synthesis of the reviewed literature revealed a consistent pattern of cytomorphological alterations in periodontal tissues following the prolonged use of removable dentures. These findings were categorized into three interrelated domains: epithelial changes, connective tissue remodeling, and microbial-inflammation interactions. Each of these domains contributes to the pathogenesis of localized periodontitis in denture-wearing individuals and represents key targets for therapeutic and preventive interventions [5,6].

Epithelial Alterations

One of the earliest and most frequently reported cytomorphological changes is the thinning or atrophy of the gingival epithelium, particularly in regions exposed to chronic mechanical pressure from ill-fitting prostheses (Davis et al., 2020). This atrophic process compromises the protective barrier function of the epithelium, allowing bacterial antigens and inflammatory mediators to penetrate into deeper tissues. Histological studies have also documented disruption of the basal lamina, desquamation of superficial epithelial layers, and vacuolar degeneration in the basal cell zone (Wang & Lee, 2022).

In some cases, especially under sustained low-grade trauma, compensatory epithelial hyperplasia may occur, leading to irregular thickening and pseudoepitheliomatous proliferation. However, such responses often fail to restore functional integrity and may instead exacerbate the inflammation through increased keratinization and surface roughness (Oliveira et al., 2019).

Connective Tissue Remodeling

The underlying lamina propria and periodontal connective tissues exhibit substantial cytological changes under the influence of mechanical irritation and microbial biofilm. These include the loss of fibroblast polarity, swelling of collagen fibers, and increased intercellular matrix disorganization. Chronic inflammation leads to fibroblastic degeneration, characterized by shrinkage of nuclei, cytoplasmic vacuolization, and eventual cellular necrosis (Patel & Smith, 2021).

Vascular changes such as capillary dilation, perivascular edema, and erythrocyte extravasation are common and indicate ongoing vascular reactivity to inflammatory stimuli. In advanced cases, neovascularization with abnormal angiogenic patterns has been observed, potentially contributing to persistent tissue swelling and bleeding upon probing.

Inflammatory Infiltration and Microbial Factors

Perhaps the most critical component in the development of prosthesis-induced localized periodontitis is the infiltration of inflammatory cells into the periodontal tissues. Multiple studies have reported dense accumulations of polymorphonuclear neutrophils, macrophages, and lymphocytes, particularly in perivascular zones and connective tissue papillae (Kim et al., 2019).

The presence of anaerobic periodontal pathogens, especially Porphyromonas gingivalis, Fusobacterium nucleatum, and Prevotella intermedia, was associated with a marked upregulation of inflammatory markers such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and matrix metalloproteinases (MMPs) that mediate tissue breakdown (Santos et al., 2018).

The role of Candida albicans as a co-pathogen has also been widely discussed, particularly in patients with poor denture hygiene or xerostomia. Fungal colonization not only aggravates the inflammatory response but also contributes to biofilm resistance and epithelial surface damage.

Preventive and Therapeutic Observations from the Literature

In response to these pathological changes, the literature emphasizes several non-invasive yet effective strategies for prevention and treatment. These include:

- Regular denture hygiene instruction and mechanical cleaning to reduce microbial load
- Use of antibacterial and antifungal agents (e.g., chlorhexidine, nystatin) to control opportunistic colonization
- Application of soft denture liners or relining procedures to minimize traumatic pressure
- Implementation of scheduled denture replacement every 5–7 years to maintain biomechanical compatibility
- Introduction of biocompatible denture base materials with lower cytotoxicity and improved tissue tolerance (Lee et al., 2023)

Moreover, the integration of chairside patient education and professional periodontal monitoring significantly enhances the long-term outcomes by allowing for early detection and intervention in cases of subclinical inflammation.

4. Discussion

The cytomorphological consequences of removable denture use in the oral cavity represent a significant intersection between prosthodontics and periodontology, yet remain underappreciated in everyday clinical practice. The results of this literature-based analysis highlight that removable dentures, while functionally beneficial for edentulous rehabilitation, pose tangible risks to periodontal health if proper hygiene and prosthetic management protocols are not followed.

As demonstrated across multiple studies, the epithelial atrophy and disruption of the basal lamina observed in denture-bearing regions are not isolated occurrences but reflect a broader pattern of cellular stress induced by mechanical trauma and microbial infiltration (Davis et al., 2020; Wang & Lee, 2022). These cytological features have important clinical implications: epithelial thinning compromises

the barrier function of the gingiva, increasing susceptibility to pathogen penetration, while basal membrane degeneration affects tissue regeneration and attachment stability.

Moreover, the presence of fibroblastic degeneration and vascular congestion in the connective tissue matrix points to a chronic, low-grade inflammatory process that often goes unnoticed until overt clinical signs such as gingival recession or periodontal pockets emerge. It is noteworthy that such cytomorphological changes precede structural damage and therefore represent valuable early indicators of developing pathology. Incorporating cytological screening tools into routine prosthodontic follow-up could thus enable preemptive intervention before irreversible periodontal destruction occurs [8,9].

Another critical aspect involves the role of the oral microbiome, particularly biofilm-forming anaerobes and opportunistic fungi such as Candida albicans. These microorganisms not only colonize denture surfaces but also interact synergistically with mechanical trauma to exacerbate mucosal and submucosal inflammation (Santos et al., 2018). Biofilms beneath the denture act as reservoirs of pro-inflammatory stimuli, sustaining cytokine production (e.g., IL-6, TNF-α) and activating host immune responses that result in connective tissue breakdown.

These findings emphasize the necessity for a multifactorial approach to prevention. Mechanical fit alone is insufficient to preserve periodontal health; biological compatibility, patient compliance, and long-term maintenance are equally critical. For example, the use of soft liners or viscoelastic relining materials has shown promise in reducing contact trauma and improving tissue tolerance, while routine denture disinfection protocols have been associated with reduced microbial burden and inflammation (Oliveira et al., 2019).

Despite these insights, challenges persist. There is currently no standardized protocol for cytological monitoring in prosthodontic patients. Histological evaluations are usually limited to biopsy cases, and cytology is not routinely performed due to lack of training, cost, or perceived clinical relevance. To overcome this, future research should focus on developing non-invasive, chairside diagnostic tools (e.g., exfoliative cytology kits, salivary biomarker assays) that can be easily integrated into prosthodontic practice.

Furthermore, the integration of interdisciplinary care models, where periodontists and prosthodontists jointly manage patient outcomes, may significantly improve early detection and reduce the burden of prosthesis-associated periodontal disease. A practical example of this would be including periodontal evaluation checkpoints in the denture recall schedule and providing customized hygiene education based on the individual patient's risk profile.

It is also essential to consider the vulnerable populations most affected by these complications—elderly individuals, patients with systemic conditions such as diabetes or chronic kidney disease, and those with reduced manual dexterity. For these groups, customized intervention plans, including antimicrobial mouthwashes, salivary stimulants, and potentially probiotic regimens, may offer better protection against mucosal damage and microbial imbalance.

In conclusion, the evidence presented in this review suggests that cytomorphological changes in localized periodontitis following removable denture use are not only prevalent but clinically significant. Ignoring these changes may delay necessary interventions, leading to worsening oral health and loss of prosthetic function. Embracing preventive strategies, improving prosthetic material quality, and implementing regular periodontal surveillance are essential steps toward improving patient outcomes in removable prosthodontics.

5. Conclusions

The review and analysis of existing literature clearly demonstrate that the use of removable dentures, while essential for oral rehabilitation, presents a notable risk for the development of localized periodontitis due to both mechanical and microbiological factors. The cytomorphological changes observed in the periodontal and gingival tissues — including epithelial atrophy, basal lamina disruption, fibroblastic degeneration, and inflammatory infiltration — serve as early and significant indicators of tissue stress and damage.

These alterations often develop silently and can progress to clinically evident periodontal disease if not identified and managed in a timely manner. Consequently, prosthodontic care should not be isolated from periodontal monitoring but must be embedded within a broader interdisciplinary approach to oral health, especially in elderly and systemically vulnerable populations.

Preventive strategies such as the use of biocompatible denture materials, proper prosthetic design, routine denture cleaning protocols, patient education, and regular professional assessments have been shown to significantly mitigate cytomorphological damage. Moreover, the potential development of non-invasive diagnostic tools for monitoring cellular changes in periodontal tissues could represent a breakthrough in early detection and targeted intervention.

In summary, improving the management and prevention of cytomorphological changes in localized periodontitis among denture wearers requires both scientific insight and clinical vigilance. By integrating histological awareness into prosthodontic planning and maintenance, dental professionals can enhance patient outcomes, prolong prosthesis functionality, and contribute to a higher quality of life for denture users.

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