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Anatomical and Physiological Changes and Hygienic Status in the Oral Cavity of Patients Using Fixed Implant-Supported Dentures

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Abstract. Fixed implant-supported dentures have revolutionized modern dentistry by providing stable, aesthetic, and functional rehabilitation for patients with missing teeth. However, their long-term use induces significant anatomical and physiological changes in the oral cavity. The presence of implants affects the surrounding bone tissue, mucosa, and salivary glands. Over time, adaptive remodeling occurs in the alveolar bone, while the mucosal tissues undergo modifications in thickness, keratinization, and sensitivity. Moreover, the altered mechanical load distribution may influence blood circulation and tissue metabolism around the implant sites.

From a physiological perspective, changes in salivary flow and composition can be observed, often associated with microbial colonization around prosthetic components. If oral hygiene is neglected, bacterial plaque accumulation can lead to peri-implant mucositis and peri-implantitis, resulting in inflammation, soft tissue recession, and even bone loss. Therefore, maintaining optimal oral hygiene practices is essential for the prevention of such complications.

Regular clinical evaluation, professional cleaning, and patient education play a crucial role in sustaining implant success. Understanding the anatomical and physiological adaptations in the oral cavity helps clinicians develop effective maintenance protocols and improve patient outcomes.

Keywords: fixed implant-supported dentures; oral cavity; anatomical changes; physiological changes; alveolar bone remodeling; mucosal adaptation; oral hygiene; peri-implant health; salivary flow; microbial colonization.

Introduction

The restoration of edentulism is one of the primary goals of modern dentistry. Today, dental implantology is considered a revolutionary achievement in this field, as implants make it possible to restore lost teeth both functionally, aesthetically, and anatomically.

In particular, fixed (non-removable) implant-supported dentures provide patients with comfort and stability comparable to natural teeth. However, long-term use of such prostheses may lead to several anatomical and physiological changes in the oral cavity, as well as deterioration of hygienic status.

- Anatomical and Physiological Changes

• Changes in the alveolar bone
During implant placement, the process of *osseointegration* occurs, through which a direct structural connection forms between the implant surface and the bone tissue.

Methodology
However, over time, the following changes may occur:

1. Bone resorption:
   If occlusal loads on the implant are not evenly distributed, microstress develops within the bone, leading to gradual resorption.
2. Disturbance of microcirculation:
   Blood flow and tissue nutrition may decrease under fixed prostheses, especially in poorly ventilated areas.
3. Bone remodeling:
   With long-term implant use, bone structure adapts to new functional loads, resulting in either thickening or thinning of the bone in the implant zone.

• Changes in soft tissues
The soft tissues surrounding implants differ anatomically and functionally from those around natural teeth:

1. Due to the absence of the periodontal ligament, there is no natural shock-absorbing mechanism around implants.
2. The epithelial attachment is weaker, allowing easier bacterial penetration.
3. As a result, peri-implant mucositis (initial inflammation) or peri-implantitis (inflammation extending into the bone) may develop.
4. Clinically, gingival hyperemia, edema, bleeding, and epithelial thickening at the margins are often observed.

• Changes in the oral mucosa

1. Continuous mechanical pressure and friction from fixed prostheses may lead to keratosis, erythema, or atrophy of the oral mucosa.
2. Long-term pressure reduces capillary circulation, resulting in trophic tissue changes.
3. In some cases, prosthetic stomatitis and chronic inflammatory lesions can develop.

• Changes in mastication and muscular function

1. The masticatory efficiency of implant-supported dentures reaches 80–90% of that of natural teeth.
2. With long-term use, tone changes may occur in the masseter and temporalis muscles.
3. When occlusal balance is disrupted, excessive loading of the temporomandibular joint (TMJ) can cause discomfort or pain.

Would you like me to continue translating the next section (about *hygienic status and maintenance*) in the same academic English style for consistency?

➢ **Religious Determinism**
Hygienic Status

• Plaque and biofilm formation
Fixed implant-supported prostheses often have areas that are difficult to clean — such as abutment connections, pontic undersurfaces, and gingival margins. These sites serve as reservoirs for **plaque and biofilm accumulation**:

1. The bacterial biofilm primarily consists of **Gram-negative anaerobic microorganisms**.
2. The most common species include:
   Porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum, and *Treponema denticola.*
3. Plaque buildup leads to **peri-implant inflammation** and **halitosis (oral malodor)**.

• Peri-implant mucositis and peri-implantitis

1. **Peri-implant mucositis** – a reversible inflammation limited to the soft tissues surrounding the implant.
2. **Peri-implantitis** – a destructive process involving both soft and hard tissues (including bone).

Clinical signs:

- Bleeding from the gingiva
- Increased probing depth
- Discoloration of peri-implant tissues
- Radiographic evidence of bone loss around the implant

• Hygienic indices
To evaluate the level of oral hygiene and peri-implant health, the following indices are commonly used:

1. **OHI-S (Simplified Oral Hygiene Index)** – assesses plaque and calculus accumulation.
2. **Plaque Index (Silness & Löe, 1964)** – measures plaque thickness at the gingival margin.
3. **Mucosal Index** – evaluates the degree of soft tissue inflammation around implants.
4. **Peri-implant Sulcus Bleeding Index (SBI)** – quantifies bleeding tendency as a sign of inflammation.

➢ Principles of Hygienic Care

• Home care

1. **Interdental brushes** – for cleaning the spaces between implant abutments.
2. **Superfloss** – for cleaning under fixed bridge pontics and implant-supported restorations.
3. **Water irrigators** – to remove food debris and biofilm by water pressure.
4. **Antibacterial mouth rinses** containing chlorhexidine, cetylpyridinium chloride, or essential oils.
5. Cleaning of prosthetic surfaces should be performed **at least twice daily**.

• Professional care

1. **Regular dental check-ups** every 3–6 months.
2. **Ultrasonic scaling** and **air-abrasive systems** for biofilm removal without damaging the implant surface.
3. **Radiographic monitoring** of peri-implant bone levels.
4. Application of **local antiseptics or antibiotics**, if indicated.

➢ Clinical Observations and Statistical Findings (Based on Literature)

Author	Year	Findings

Renvert & Quirynen	2015	10-year observation showed peri-implant mucositis in 28% and peri-implantitis in 12% of implant patients.
Lindhe & Lang	2018	5-year clinical study revealed that 40% of fixed prosthesis users developed gingival alterations due to inadequate hygiene.
Albrektsson	2019	7-year observation reported a mean peri-implant bone loss of 1.2 mm.

Thus, although fixed implant-supported prostheses are considered a major achievement in modern dentistry, their successful and long-term use requires a comprehensive approach. This approach includes the following:

1. Proper selection of the implant and prosthesis design, ensuring biomechanical compatibility;
2. Development of the patient's individual oral hygiene skills;
3. Continuous professional supervision and preventive treatments;
4. Timely intervention in case of inflammation or signs of bone loss.

Conclusion

Only under these conditions can the functional and aesthetic advantages achieved through the use of fixed implant-supported prostheses be long-lasting and stable. Therefore, alongside achieving excellent technical outcomes, maintaining biological balance and oral hygiene should be regarded as one of the main objectives of implantology.

Referance

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