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DIFFERENT IMPLANT SYSTEMS IN PROSTHODONTICS: A COMPREHENSIVE REVIEW

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ABSTRACT

Dental implants have significantly transformed the field of prosthodontics by offering fixed replacements for missing teeth. Over the decades, implant systems have evolved in terms of materials, design, surface modifications, and biomechanical concepts. This review explores the history, classification, clinical considerations, and the latest innovations in implant systems, with an emphasis on their prosthodontic applications.

KEYWORDS: *Dental Implants, Prosthodontics, Osseointegration, Implant Systems, Surface Modifications, Implant Design.*

1. INTRODUCTION

Implant-supported prostheses have become the standard of care for edentulous and partially edentulous patients. The development of implant systems—from subperiosteal and transosteal to modern root-form implants—has improved clinical outcomes. Different systems have varying designs, materials, connections, and prosthetic implications, which impact the long-term success of treatment.[1]

2. HISTORICAL EVOLUTION OF IMPLANT SYSTEMS

2.1 Ancient Trials

- Ancient civilizations used shell, ivory, and stone as implants (e.g., Mayans).
- These had no concept of osseointegration.

2.2 Modern Implantology: Branemark's Discovery[2]

•In 1952, Prof. Per-Ingvar Branemark introduced osseointegration—a breakthrough that transformed implantology.

3. CLASSIFICATION OF IMPLANT SYSTEMS[3]

Implant systems are classified based on various factors:

3.1 Based on Design

- Endosteal Implants: Most common; placed into bone.
- Subperiosteal Implants: Placed over the bone but under periosteum.
- Transosteal Implants: Rare; through the mandible.

3.2 Based on Implant Shape

- Screw-Type (cylindrical or tapered)
- Blade-Type: Obsolete; used in narrow ridges.

3.3 Based on Surface Treatment

- Machined
- Acid-Etched
- Sandblasted
- HA-Coated (Hydroxyapatite)

3.4 Based on Connection

- External Hex
- Internal Hex
- Morse Taper
- Platform Switch

4. IMPLANT MATERIALS[4]

4.1 Titanium and Its Alloys

- CP Titanium (Grade 4): Gold standard due to biocompatibility.
- Ti-6Al-4V: Higher strength.

4.2 Zirconia Implants

- Ceramic, esthetic, and metal-free.
- Used especially in anterior regions.

5. SURFACE MODIFICATIONS AND THEIR IMPACT[5]

- Sandblasting + Acid Etching: Increases roughness for better bone contact.
- Plasma-Sprayed Surfaces: Titanium or hydroxyapatite coatings improve integration.
- Nanostructuring: Promotes cellular responses and faster healing.

6. EXTERNAL HEX[6]

- Traditional, common in Branemark system.
- Prone to micro-movement and screw loosening.

6.1 Internal Connections

- Internal Hex and Morse Taper improve stability and stress distribution.
- Platform Switching reduces crestal bone loss

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7. PROSTHODONTIC CONSIDERATIONS[7]

- Cement-Retained vs. Screw-Retained prostheses.
- Single-Unit, Fixed Partial Dentures, and Full-Arch Restorations.
- Occlusion, emergence profile, and esthetics are system-dependent.

8. DIGITAL IMPLANT SYSTEMS[8]

8.1 Guided Surgery

- CBCT and CAD/CAM guide the precise placement.

8.2 Custom Abutments

- Milled to patient-specific anatomy.

8.3 Immediate Loading

- Enhanced by newer surfaces and digital planning.

9. SHORT AND NARROW IMPLANTS[9]

- Useful in atrophic ridges.
- High success in select cases due to improved surface technologies.

10. ZYGOMATIC AND PTERYGOID IMPLANTS

- For maxillary atrophy.
- Avoids sinus lifts; enables full-arch prosthesis.

11. PERI-IMPLANTITIS AND MAINTENANCE

- Design and surface influence plaque accumulation.
- Lasers, air abrasion, and mechanical debridement used in management.

12. RECENT TRENDS[10]

Innovation	Purpose
Nanocoated surfaces	Accelerate healing
3D Printed implants	Patient-specific
Drug-eluting surfaces	Reduce infection risk
Smart implants	Track osseointegration

13. CHALLENGES AND FUTURE DIRECTIONS

- Achieving predictable results in compromised bone.
- AI and Robotics in surgical navigation.
- Biomimetic materials that integrate both hard and soft tissues.

14. CONCLUSION

Implant systems in prosthodontics have rapidly evolved from experimental to highly predictable restorative tools. Selection of implant system should be based on clinical need, bone anatomy, prosthetic design, and long-term prognosis. Advances in materials, surfaces, and digital technology have revolutionized treatment, but clinical skill and individualized planning remain essential.

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