Review Of Different Surfaces Of Implants

Shadi Alghamdi BDS[1],
Comprehensive Dentistry, NYU College of Dentistry
-Nima Patel DMD[2], NYU College of Dentistry
-Philip Kotick DDS[3], NYU College of Dentistry
New York University, College of Dentistry

INTRODUCTION

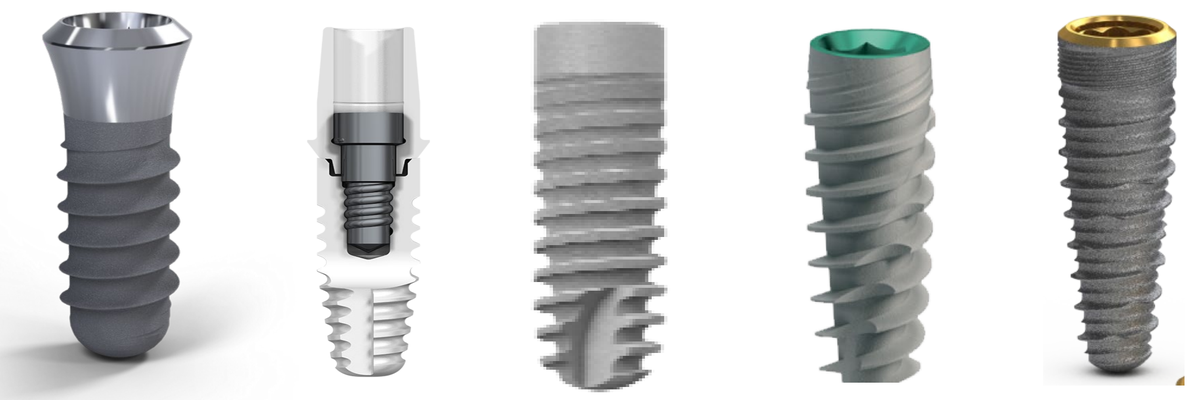
A dental implant is defined as a surgical component that interfaces with the bone of the jaw or skull to support a dental prosthesis such as a crown, bridge, denture, facial prosthesis or to act as an orthodontic anchor. Many developments have been introduced in this field since the invention of implants. Nowadays, dental implants represent a reliable treatment option in oral rehabilitation of partially or fully edentulous patients in order to secure various kinds of prostheses.

Why dental implant surface matters ?

Surface has an important role in healing time for osseointegration and, ultimately the success of implant treatment. It is the only part of the implant exposed to the surrounding oral environment, and its chemical, physical, mechanical, and topographic surface characteristics are all crucial to maximize the likelihood of successful osseointegration. The primary aim of the surface texturing or treating the implant surface is to enhance cellular activity and improve bone apposition.

Most common systems:

Straumann
1.Nobel Biocare (Danaher)
2.Dentsply Sirona (Previously Astra Tech)
3.Zimmer Biomet
4.BioHorizon



(1) (2) (3) (4) (5)

Methods of surface modification :

•**Mechanical treatments:** These include grinding, blasting and machining to create rougher or smoother surfaces.
•**Chemical treatments:** Conducted with acids, alkali, sol gel or through anodization, among other methods, chemical treatments alter the implant surface's roughness and composition and enhance surface energy.
•**Physical treatments:** These treatments include plasma spraying and ion deposition
•Though these treatment methods vary, their intended outcome remains the same to provide a strong biological and mechanical connection to the alveolar bone in a short time period, and ultimately reduce the likelihood of implant failure

Overview of implants and their respective surface treatments :

SURFACE TREATMENT	IMPLANT SYSTEM/SURFACE
Acid-etched Etching with strong acids increases the surface roughness and the surface area of titanium implants.	BIOMET 3i OSSEOTITE® and NanoTite™
Anodized This electrochemical process thickens and roughens the titanium oxide layer on the surface of implants.	Nobel Biocare TiUnite®
Blasted Particles are projected through a nozzle at a high velocity onto the implant. Various materials, such as titanium dioxide, aluminum dioxide and hydroxyapatite (HA) are often used. HA treatments also include microtextured (MTX) surface treatments and RBM surface treatments *(Figs. 2a, 2b)*.	DENTSPLY Implants ASTRA TECH TiOblast™, Zimmer Dental MTX™, Inclusive® Tapered Implants
Blasted and acid-washed/etched Implants undergo a blasting process. Afterward, the surface is either washed with non-etching acid or etched with strong acids.	CAMLOG Promote®, DENTSPLY Implants FRIALIT® and FRIADENT® plus, Straumann® SLA®
Hydroxyapatite (HA) HA is an osteoconductive material that has the ability to form a strong bond between the bone and the implant.	Implant Direct (various), Zimmer Dental MP-1®
Laser ablation High-intensity pulses of a laser beam strike a protective layer that coats the metallic surface. As a result, implants demonstrate a honeycomb pattern with small pores.	BioHorizons® Laser-Lok®
Plasma-sprayed Powdery forms of titanium are injected into a plasma torch at elevated temperatures.	Straumann® ITI® titanium plasma-sprayed (TPS)

CONCLUSION

The central focus of implant development is to minimize bacterial adhesion while promoting recruitment adhesion, and proliferation of osteogenic as well as fibroblastic cells in order to gain a high degree of hard and soft tissue integration.

To guarantee long-term success in clinically challenging conditions, the development of multifunctional surface modifications and coatings is necessary.
The goal of future research is to design a single polyvalent implant type with enhanced clinical behavior in regard osseous and fibrous integration and prevention of peri-implantitis.

References

Özcan M and Hämmerle C, Titanium as a reconstruction and implant material in dentistry: advantages and pitfalls. Materials. 2012 Sep.

Abraham CM. A brief historical perspective on dental implants, their surface coatings and treatments. Open Dent J 2014;8:50-55.
Ogle OE. Implant surface material, design, and osseointegration. Dent Clin North Am.
Brånemark PI, Zarb GA, Albrektsson T. Tissue-integrated prostheses: Osseointegration in clinical dentistry. Chicago: Quintessence;.