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# Effects of Surface Treatment on Titanium for Dental Implants: A Review

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**ABSTRACT**

**Background:** This paper reviews the effects and consequence of important surface treatments on titanium implant. **Objective:** Effects of each treatment will be discussed in detail in order to compare the effectiveness in promoting good properties on implant. write background about topic of paper**.** Published literatures for the last 10 years between 2002 and 2012 were searched electronically by using important keywords like titanium, dental implant, surface roughness, coating and osseointegration. Surface modification played an important role in providing roughness surface for bone-implant contact and removal torque, despite of having good mechanical properties. **Results:** Thus, a good combination of surface roughness and mechanical properties of titanium could lead to successful dental implants. write the main objective for your paper. write the main and most important results for your paper**. Conclusion:** Overall, published studies indicated that an acid etched surface-modified commercial pure titanium (cpTi) implant was most preferable in enhancing the surface roughness as well as osseointegration due to its biocompatibility properties.



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## INTRODUCTION

Pure titanium and titanium alloys are well established standard materials in dental implants because of their favorable combination of mechanical strength, and biocompatibility. Classically, to get specific properties on titanium dental implant, surface treatment is done on its surface. Surface modification of titanium dental implant are focus at improving osseointegration and create an ideal surface roughness for the implant functioning. In order to accelerate the rate of osseointegration, increasing the surface area of implants through roughening of the surface of implants were introduced. Rough-surfaced implants favor both bone anchoring and biomechanical stability. The different methods of surface treatment to increase the roughness and applying coating onto titanium dental implants are review. Descriptions of surface treatments are shown in Figure 1.

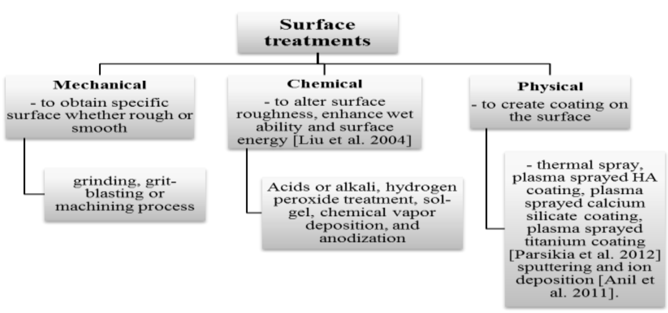


**Fig. 1:** Type of surface treatments.

A surface treatment in various types has been reported. Table 1 summarises the surface treatment that are commonly used in the research works which are carried out between 2002 till 2012.

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**Table 1:** Research study on common used of surface treatment/surface modification in dental implants and the findings.

| *Types of surface treatments* | *Findings* | *Authors* |
|---|---|---|
| 1. Coating<br>a) Plasma spray coating<br>b) Dip coating<br>c) Magnetron sputtering | • Exhibits highest value of surface roughness (3.43±0.63 μm) compared to machined surface<br>• Bone apposition and osseointegration was improved for surface with $ZrO_2$ coating compared to uncoated one.<br>• HA-$ZrO_2$-$Al_2O_3$ shows the highest adhesion strength compared to HA coating.<br>• $ZrO_2$–Ag and $ZrO_2$–Cu coatings improve the antibacterial performance relative to pure Ti implant materials | [1]<br>[2]<br>[3]<br>[4] |
| 2. Grit blasting | • The integration of zirconia particles in titanium surface using blasting technique increases the microhardness when compared to the control polish titanium surface<br>• Titanium implant with blasted $ZrO_2$ surface exhibits greater bacterial adhesion compared to other surface treatments | [5]<br>[6] |
| 3. Acid etching and dual acid etching | • Surface roughness of cpTi implant after acid etching was greater for sample with higher concentration of acid (0.44-3.51 μm).<br>• Titanium samples acid etched by $H_2SO_4$ acid only but in different concentration demonstrated surface roughness is increased within concentration<br>• Acid etched zirconia implant surface shows significantly improved in cell proliferation improvement.<br>• Acid treated surface has greater resistance to reverse torque removal and better osseointegration than machined surface implants. | [7]<br>[8]<br>[9]<br>[10] |
| 4. SLA<br>(sandblasted and acid etching) | • SLA surface shows wide cavities (5–20 μm in diameter) and micropits (~0.5–3 μm in diameter), which indicated the surface roughness and surface area increased.<br>• Surface after grit-blasting and alkaline treatment in sequence, shows high shear strength which can lead to improve and rapid the early ingrowth of bone and osseointegration.<br>• Human osteoblasts growth splendidly on SLA surface which provides space for cell attachment and proliferation. Formation of bone along the implant indicated SLA surface had good biocompatibility. | [10]<br>[11]<br>[12] |
| 4. Ion implantation | Ion implantation coating method has resulted in an improved osseointegration than control implant (untreated surface). | [13] |
| 5. Laser treatment | • Nd: glass laser has found removal torque of implants larger by 20% for laser treated surface compared to machined and blasted implant.<br>• The removal torque value was larger for laser modified implant (52 Ncm) than machined surface implant (35 Ncm) after 12 weeks of healing | [14]<br>[15] |

***Conclusion:***

In general, most preferable surface treatments are acid etching modification. Acid etching played an important role in producing good surfaces; with surface roughness ranging from 0.44 to 3.51 µm. The dual acid etching is better than a single acid etching due to its high composition, amount and concentration. Thus, a good of surface roughness and mechanical properties of titanium could lead to successful dental implants.

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