Laboratory: Metallurgical
Report No.B/138310

Work No. K173876

Dental Solution Israel January 24, 2019
Trade/Device Name: Implant DSI Premium Line

Client: DSI ltd. haAvoda 59, Light Industrial Zone, Ashdod, Israel
Product Code: Premium Line SLI3810, BATCH NO-15569

Dated: December 27, 2018
Received: January 3, 2019

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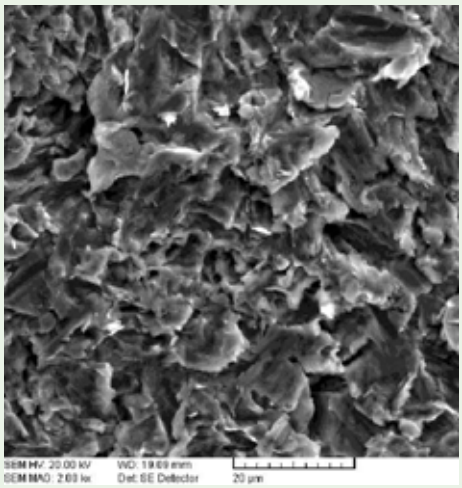
COMPARISON OF THE DENTAL IMPLANT SURFACES

Different techniques have been used to alter the surface topography of dental implants. The question of the difference between implant surface treatment is one of the most frequently asked nowadays. What is the main divergence? Which to choose? And the main question – which factors depend on the implant surface?
Let's try to answer them by comparing the two most popular techniques: SLA and RBM.

SLA (Sand-blast, Large-Grit, Acid-etch) – Implant surface is blasted by rough corundum particles of aluminium oxide to achieve macro-roughness of titanium. Next stage is high-temperature acid batch with a mixture of hydrochloric and sulfuric acids. As a result, thin micro-cavities are formed as the surface inclusions of 2-4 microns in size.

RBM



SLA

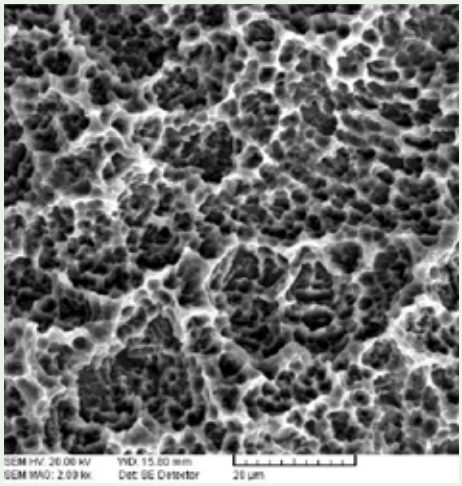


Fig 1. SEM of both surfaces at 2000x magnification. RBM surface, top image and SLA surface, the bottom image.

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This surface doesn't provide a place for bacterial colonisation and tissue inclusions and shows good initial survival rates and improved osseointegration.
The SLA technique is widely used in implant production and been intensively studied both in-vivo and in-vitro. Histomorphometric (cell cultures, local cytokines and growth factor formation) and functional (high-torque screwing and disengaging) tests show an overwhelming advantage over older generation surface treatments – machine milling, plasma spraying, hydroxyapatite coating, etc., while the strongest point of the SLA treatment is a possibility of high and immediate load on the implant.
However, the SLA is not flawless. The main disadvantage of this technique is alumina remains. During the sandblasting, aluminium oxide residuals are often staying on the surface, which many studies show, based on spectral analysis and electron microscope (SEM) scanning.

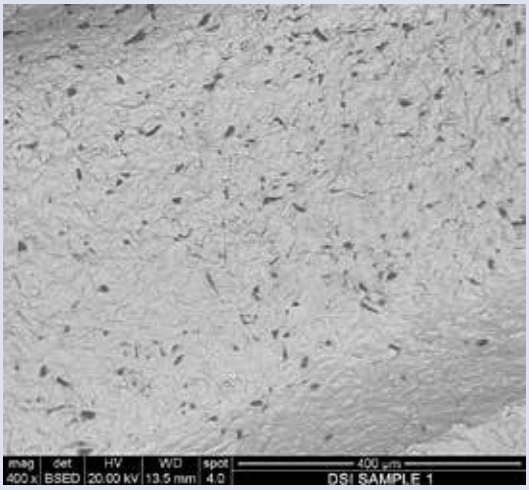

Fig 2. An area at x400 magnification from the center of the implant – SLA surface.

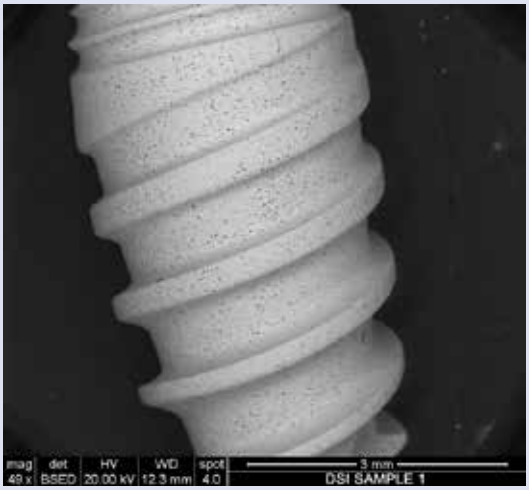

Fig 2-1. An area at x40 magnification from the center of the implant – SLA surface.

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It could significantly impair the osseointegration process, while the effect of aluminium particles on the body is not directly connected to its concentration on the implant. The only way to wash out those particles is higher concentration and longer immersion time of the acid bath during the etching process.
On the other hand, excessive acid exposure and too aggressive etching may have so-called “metallurgical decay” effect, reducing the durability and smoothens the optimal surface roughness, which has been formed by the sandblasting previously. In addition, there’s a considerable chance of acid residues that will remain.

The second technique called **RBM** (Resorbable Blast Media).
The RBM methodology is based on the same high-speed particle blasting principle, but using the resorbable coarse bioceramics – Beta-TriCalcium Phosphate material. After the mechanical abrasion, the

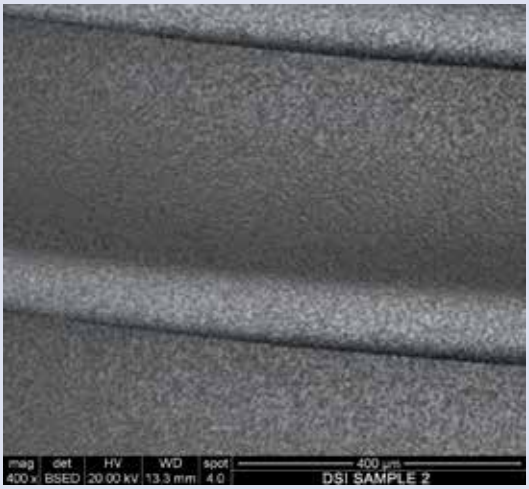

Fig 3. An area at x400 magnification from the center of the implant – RBM surface.

Fig 3-1. An area at x40 magnification from the center of the implant – RBM surface.

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surface is etched with organic acid of low concentration, cleaning the surface from calcium particles without a residue without changing the titanium surface "pattern". This method targets the range of optimal micropore diameter and surface roughness. Homogenous pore diameter and uniform surface promote new bone formation during the initial attachment stage. The surface is increased due to larger and deeper pores (craters).
bTCP is a resorbable material often used in synthetic bone graft composition. In most cases, it doesn't bond to the surface of the implant, and if it does, it is completely resorbed and replaced by the new bone formation. The body doesn't see it as an "alien" microparticle, and it cases no immune reaction.

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Advantages of the RBM

- Cleaner implant surface – eliminates the risk of leaving contaminating debris after blasting.
- Optimal homogenous pore diameter contribute to the mineralized bone formation.
- No titanium abrasion or acid residue for higher initial survival rates.
- Improved surface roughness - better and an accelerated process of healing toward achieving osseointegration.
- Enlarged implant surface area – larger bone-to-implant contact for improved implant stability.
- Used by a top-tier dental implant companies such as BioHorizons, Osstem, AB Dental, Megagen.

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