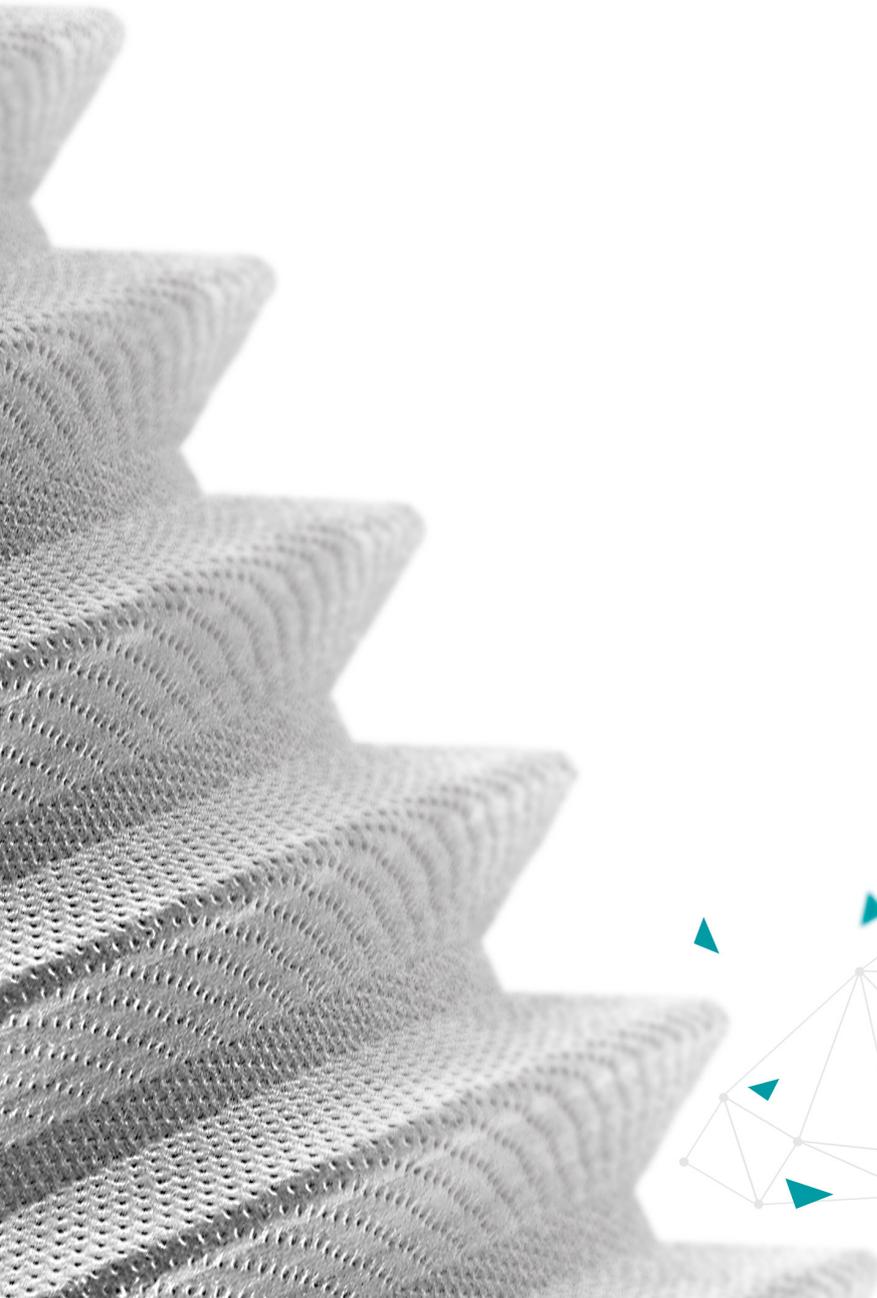




synthegra

The surface which fights peri-implantitis



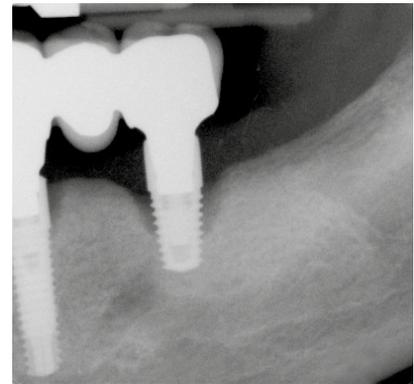
Fighting peri-implantitis for long term osseointegration: the new challenge

At the end of the Nineties, research for better performance led to the creation of new implant surfaces, characterized by a certain level of roughness in order to further stimulate osseointegration^{1,2,3}.

In many cases the effects that surface roughness can have on bacterial adhesion and the relative consequences to **long term implant success** were ignored.

Now, some years on, more and more cases which had used **rough implants** need **reintervention**, generating dissatisfaction both for the dentist as well as for the patient, a loss of time and an increase in costs.

The **new challenge** for an implant surface today is to answer **two needs** at the same time: **reducing risks of infection** which may prejudice implant survival and the **promotion of long term osseointegration**.

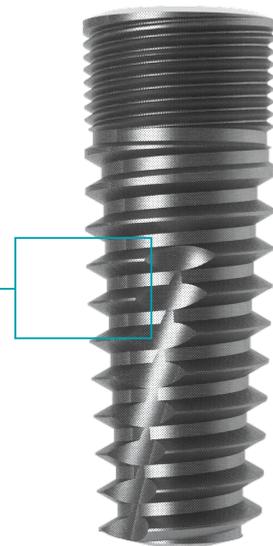
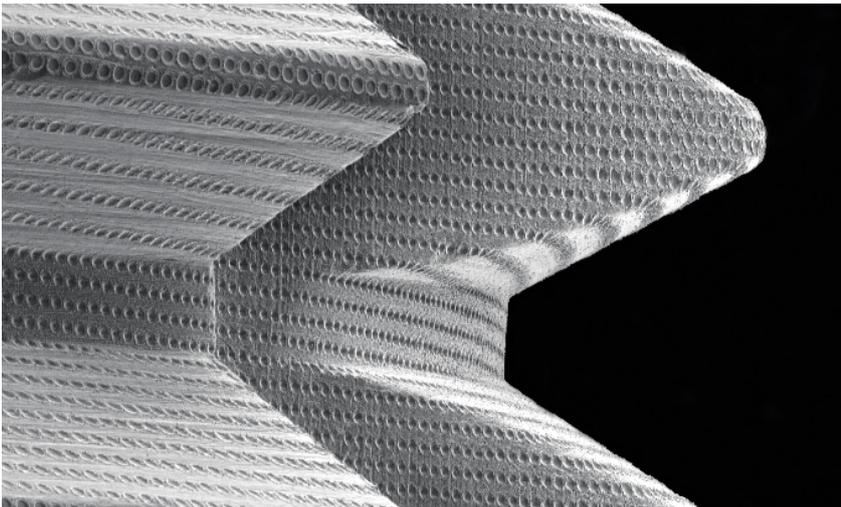


Various studies state that the peri implantitis problem concerns around 20% of patients and 10% of implants^{4,5,6}, percentages which seem destined to increase over the next few years.

Enemies of bacterial adhesion, friends of osseointegration

Geass research has developed and patented⁷ **Synthegra**, the laser treated surface which **acts in two ways**: it fights periimplantitis and promotes osseointegration for long term success. In fact, Synthegra:

- 1 is a smooth surface, able to obstacle bacterial adhesion
- 2 acts like a rough surface promoting osseointegration



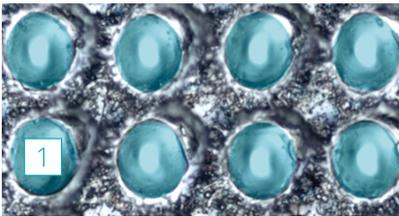
Synthegra technology has been patented to treat the entire implant body, regardless of the shape, diameter and length of the way and omny implants, the implant-prosthetic systems designed by Geass.

Synthegra obstacles bacterial adhesion, being a smooth surface

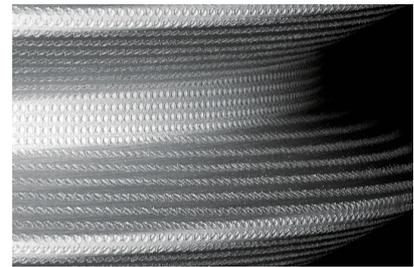
The use of laser technology makes it possible to create a geometrically controlled surface, characterized by thousands of **niches** each one the same as the others in terms of **shape, dimension** and **distribution**.

The nature of the niches and the inter spacing is **extremely smooth**, a characteristic which **obstacles bacterial adhesion**.

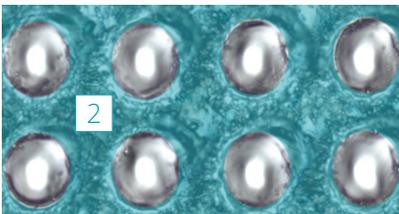
1 Internal niches



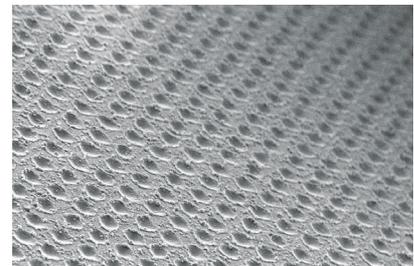
Thanks to the laser effect, the surface of the **niches** (indicated part) is very smooth, with a Ra value equal to **0,1 μm** .



2 External niches



Even **outside** the niches (indicated part), the surface is smooth, with a Ra value equal to **0,4 μm** .



According to the classification of the surfaces, based on the degree of roughness, the Ra values of Synthegra inside and outside the niches correspond to those of the smoothest surfaces.

Synthegra has resulted in being smoother than the machined surface, recognized by clinical experience as the standard reference to reduce bacterial adhesion and the risk of periimplant infections⁹.

Roughness (Ra)	Definition
$\leq 0,4 \mu\text{m}$	smooth
0,5 - 1,0 μm	machined
1,0 - 2,0 μm	moderately rough
$> 2,0 \mu\text{m}$	rough

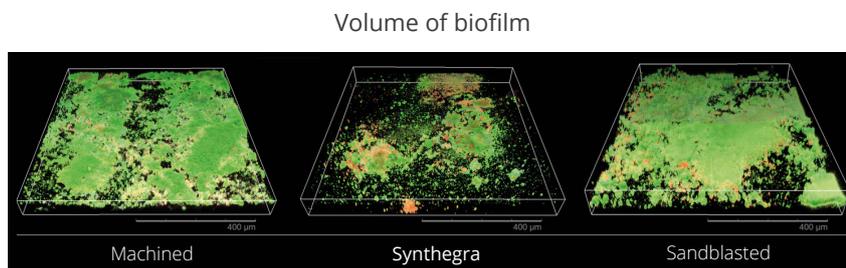
Classification of the surfaces according to Albrektsson and Wennerberg⁹.

Studies that confirm the reduction of biofilm formation

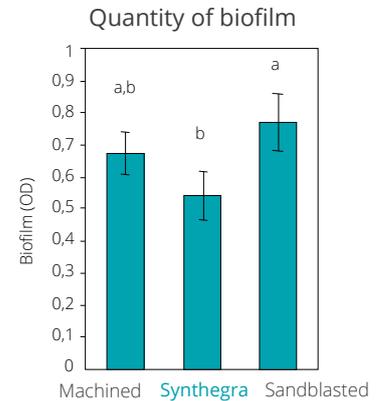
To evaluate the biofilm formation on Synthegra, an *in vitro* study and an *in situ* study were conducted in collaboration with the I.R.C.C.S. Galeazzi in Milan¹⁰.

In vitro study

An oral bacterial culture, coming from a saliva inoculum, has been set up on titanium disks inside a bioreactor and incubated for 48 hours.



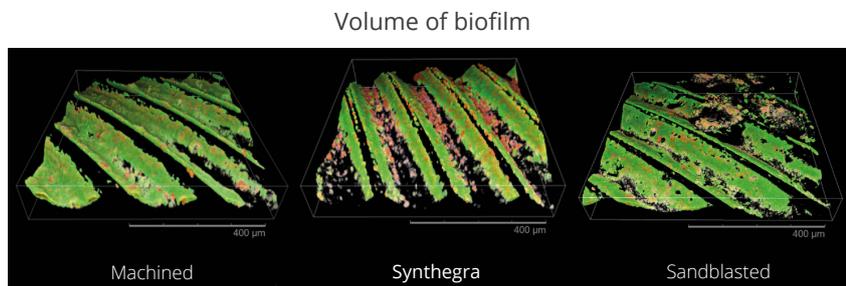
CLSM reconstructions of *in vitro* biofilm formation on different surfaces
In all reconstructions, viable microorganisms are stained in green, while dead microorganisms are stained in red.



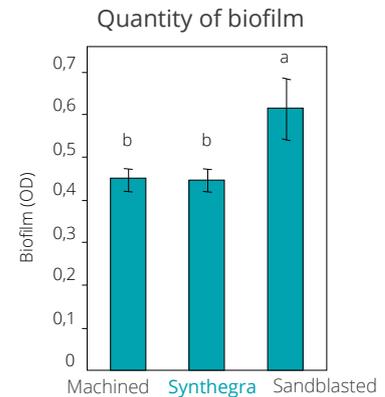
MTT viability biochemical assay, comparing biofilm levels among the machined, Synthegra and sandblasted surfaces.

In situ study

The dental implants have been fixed on intraoral trays, then inserted in the oral cavity and maintained for 48 hours.



CLSM reconstructions of *in situ* biofilm formation on machined (A), sandblasted (B) and Synthegra (C) surfaces. In all reconstructions, viable microorganisms are stained in green, while dead microorganisms are stained in red.



MTT viability biochemical assay, comparing biofilm levels among the machined, Synthegra and sandblasted surfaces.

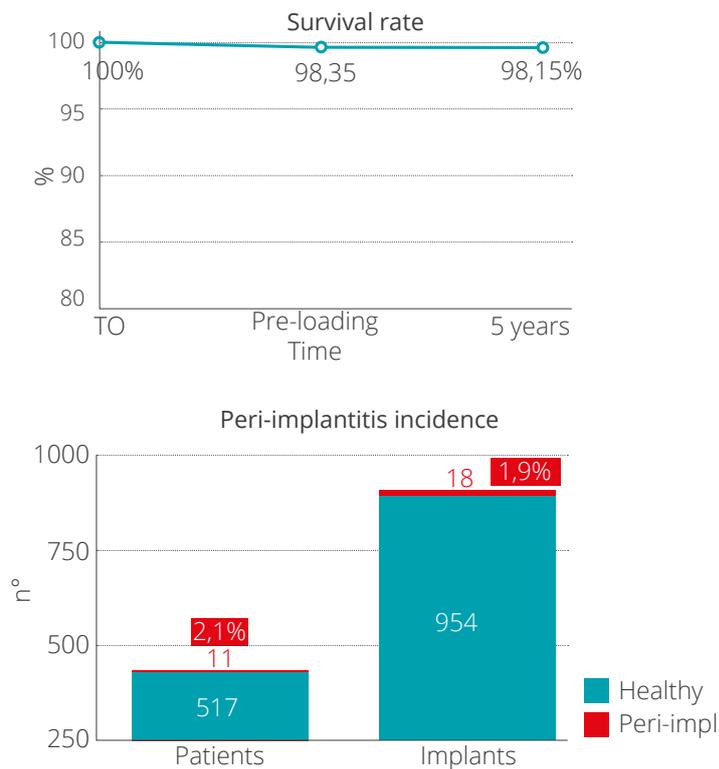
Results

In both studies, the volume and quantity of the viable biofilm on Synthegra surface are significantly lower than the sandblasted surface and comparable to the machined surface.

Retrospective Clinical Study: evaluation of the survival rate and incidence of peri-implantitis

Geass is collecting clinical data in a retrospective study, evaluating the behaviour of way implants with the Synthebra surface in the medium term.

The preliminary data confirm a high percentage of success and a low incidence of peri-implantitis*.



Materials and methods

The study involved **4 dental clinics** with over **1000** way Milano **implants** inserted on **500 patients**.

The patients included were treated consecutively from 2008 to 2013.

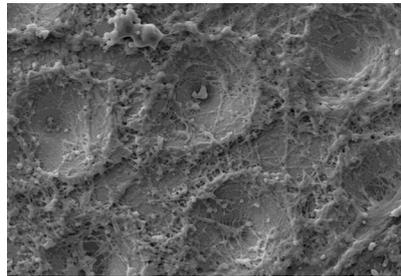
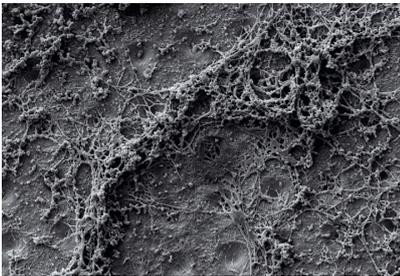
All the edentulia (single, partial and total) and all the prosthetic rehabilitation techniques with prosthetic loading at at least 12 months were considered.

Thanks to its extremely smooth nature, Synthebra is less attackable by bacteria and so reduces the risk of infection which may produce peri-implantitis.

Synthegra behaves like a rough surface: it promotes osseointegration

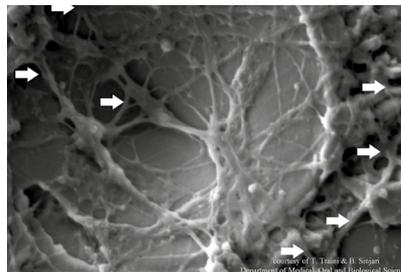
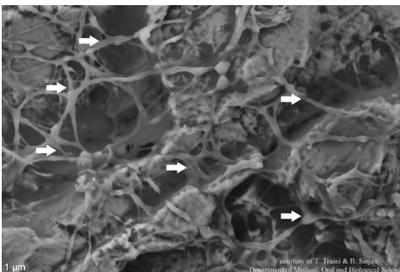
Synthegra **stimulates the formation** of a coagulation of the extended **fibrin**¹¹, which attracts the cells involved in bone healing and allows them to reach the surface of the implant.

The topographical distribution and the dimensions of the niches favour their housing and the activity of the osteoblasts determine effective osseointegration^{12, 13}.



SEM images in which it is possible to observe the formation of the fibrin on Synthegra and on the surface of the niches (University of Chieti – Pescara).

On the traditional rough surface, the **fibrin filaments** are able to adhere nearly exclusively to the peaks of the surface forming bridges between them. However, on Synthegra the fibrin manages to form well-developed lattices **in the valleys too**, favouring housing of the **osteogenic cells** directly on the implant surface.



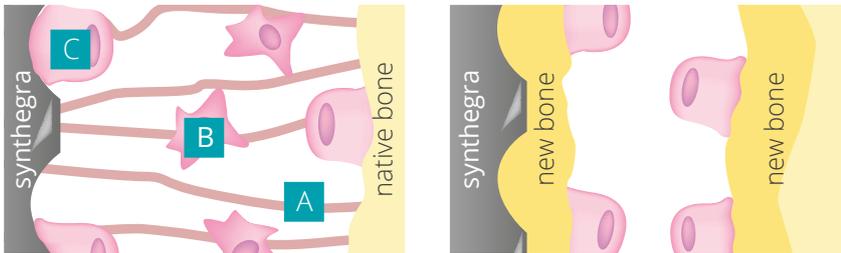
Sandblasted machined

Synthegra

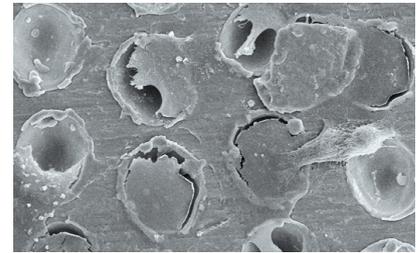
The SEM images show how the filaments of fibrin adhere in different ways to the Synthegra surface and to the sand-blasted surface (University of Chieti – Pescara).

Greater contact osteogenesis

Thanks to the elevated fibrin adhesion, **Synthebra** attracts a larger number of osteogenic cells and allows them to house themselves stably on the implant surface. This process activates the formation of bone directly in contact with the implant, determining a faster and more favorable osseointegration.



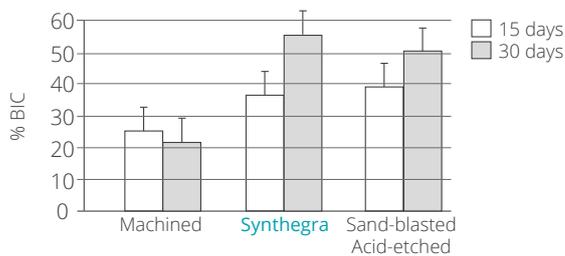
The pre-osteoblasts migrate along the fibrin filaments and reach Synthebra, where they begin to deposit new bone (in dark yellow). The formation of new bone originates both from native bone as well as from Synthebra. A. fibrin - B. pre-osteoblasts - C. osteoblasts



The SEM image shows how the osteoblasts found ideal housing in the niches which characterise Synthebra (image provided by certified laboratory analyses).

Rapid osseointegration

Even though it is a smooth surface, able to reduce bacterial adhesion, **Synthebra** favours osseointegration with its strong contact osteogenesis, as demonstrated by an in vivo study on sheep.



Implants with machined, Synthebra and sand-blasted-acid etched surfaces were inserted into spongy bone of the iliac crest and were then removed after 15 and 30 days (University of Chieti-Pescara).

Results

From the study, it results that already at 15 days the percentage di BIC (Bone Implant Contact) for **Synthebra** is greater than that of the machined surface and can be compared to the better performing rough surfaces.

Synthebra, as well as guaranteeing a lesser risk for bacterial adhesion, ensures **excellent osseointegration** in a short time¹⁴⁻¹⁹.

Synthegra doubly unique, doubly effective

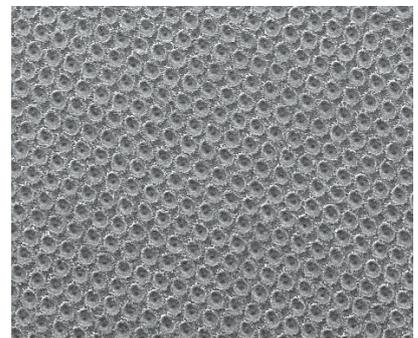
Synthegra is the only implant surface treated by laser which can boast:

1

- an extremely smooth nature
- lesser bacterial adhesion



less risk of peri-implant infection

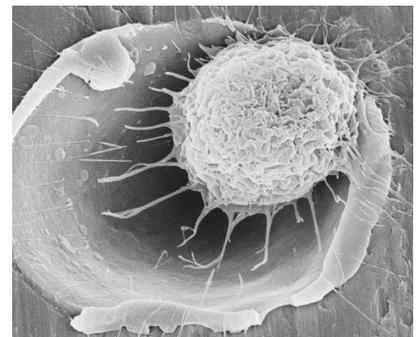


2

- greater adhesion of the fibrin
- greater contact osteogenesis



perfect osseointegration



From Italian research performed by Geass, Synthegra is the safe answer and at the forefront against peri-implantitis, rising up to the new challenge of long term osseointegration.

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Synthegra and the implants Geass

Synthegra is the laser implant treatment applied by Geass on its prosthetic implant systems.

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