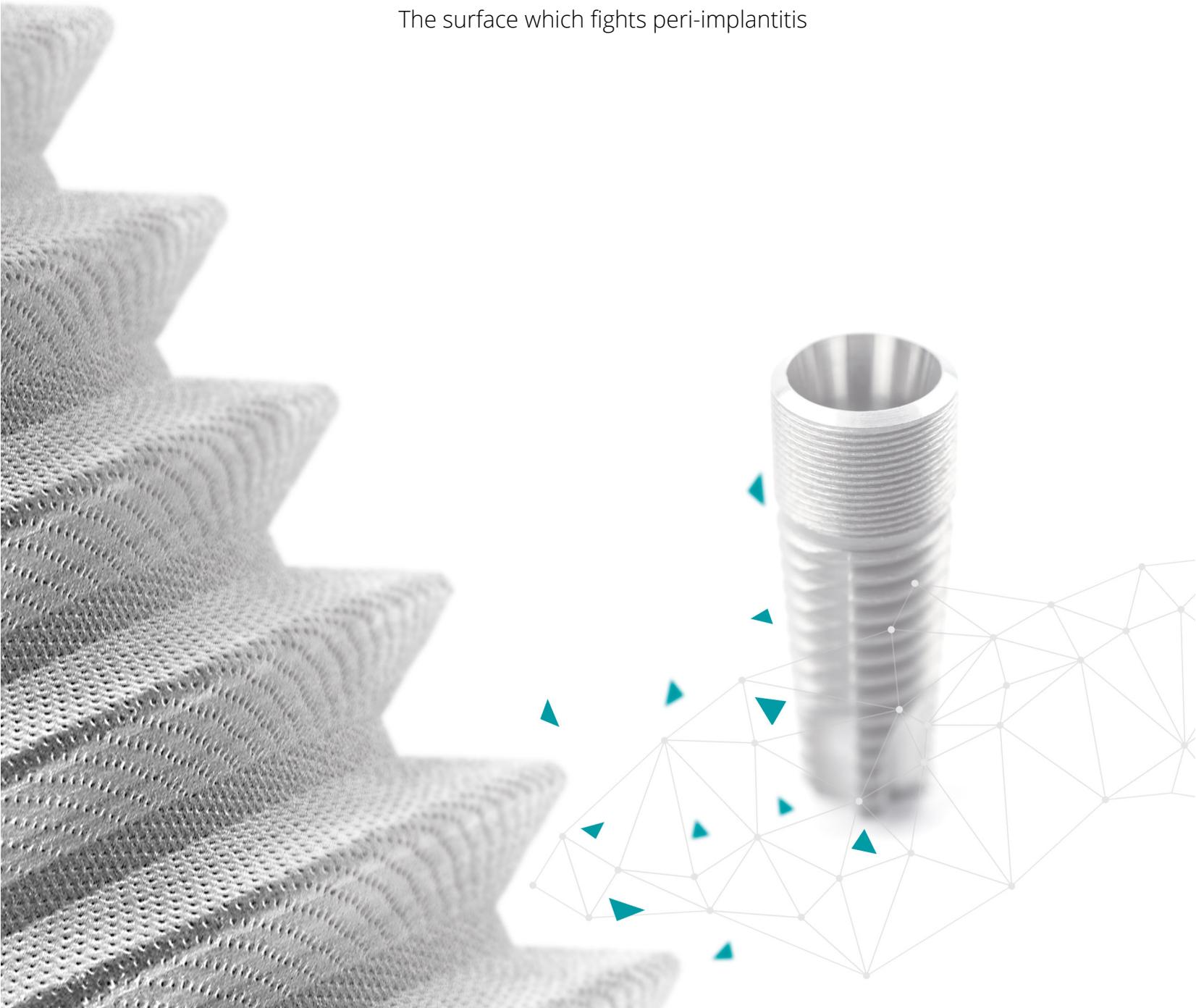




# synthegra

The surface which fights peri-implantitis



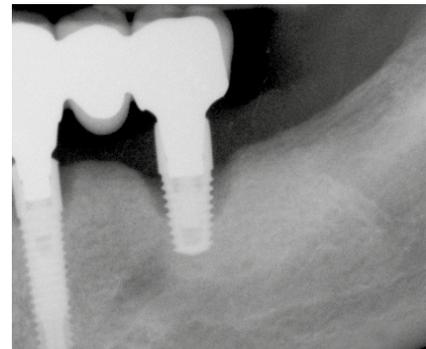
## ▶ Fighting peri-implantitis for long term osseointegration: the new challenge

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<sup>1,2,3</sup>.

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.

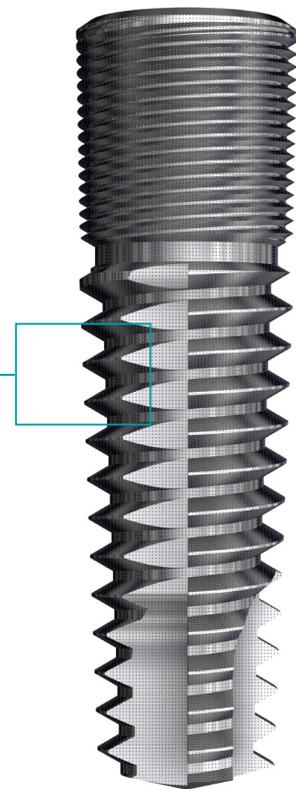
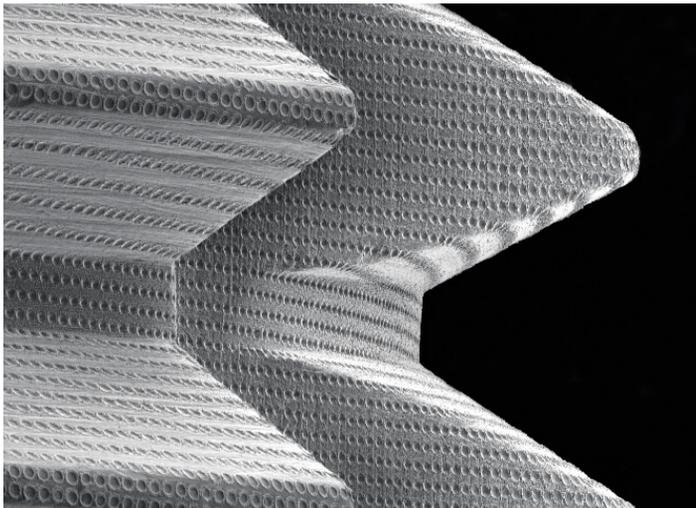


The most recent data (Mombelli 2012) states that this problem concerns about 20% of patients and 10% of implants<sup>4</sup>, percentages which seem destined to increase over the next few years.

## Enemies of bacterial adhesion, friends of osseointegration

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

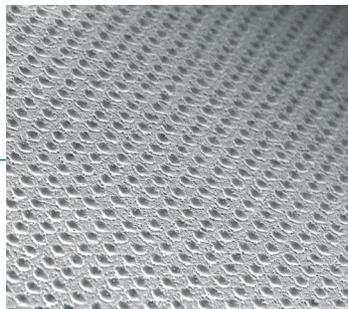
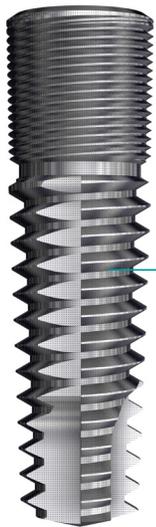
- 1 is a **smooth surface**, able to obstacle bacterial adhesion
- 2 acts like a **rough surface**, promoting osseointegration



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

## 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**.



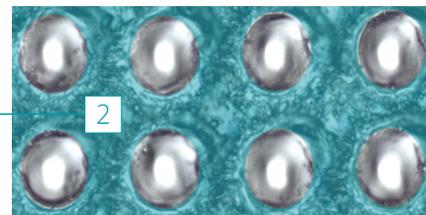
Synthegra

### 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  $\mu\text{m}$ .

### 2 External niches



Even **outside** the **niches** (indicated part), the surface is smooth, with a Ra value equal to 0,4  $\mu\text{m}$ .

According to the classification of the surfaces of Albrektsson and Wennerberg<sup>7</sup>, the Ra values 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 infections<sup>8</sup>.

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

Classification of the surfaces according to Albrektsson and Wennerberg.

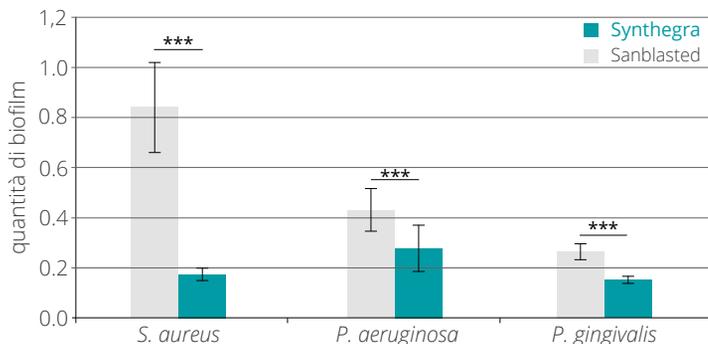
# Experimentation that confirms the reduction of bacterial adhesion

Studies conducted by IRCCS Galeazzi

To verify the reduction of bacterial adhesion on Synthegra, an in vitro study has been conducted in collaboration with the I.R.C.C.S. Galeazzi in Milan<sup>9</sup>.

## Evaluation of the quantity of bacterial biofilm

The analysis of the bacterial biofilm has been carried out first through spectrophotometry, to evaluate the quantity of biofilm on a sand-blasted surface and on Synthegra.



Analyses carried out through spectrophotometry Christensen method<sup>10</sup>. Data expressed as average absorbance at 595 nm  $\pm$  SD. \*\*\* P < 0.001 (I.R.C.C.S. Galeazzi).

### Results

For the three species of bacteria analysed, the quantity of biofilm present on Synthegra is inferior to that on the sand-blasted surface and the reduction can be observed in:

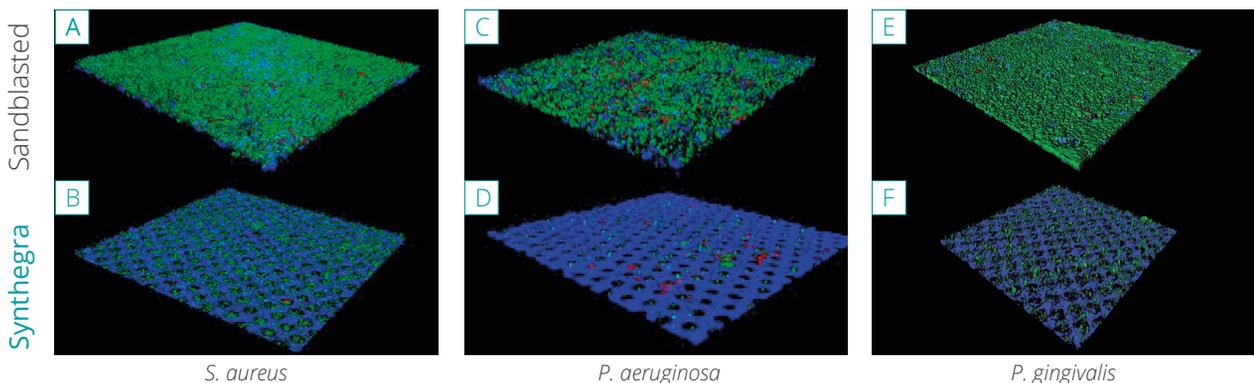
79% for *S. aureus*

36% for *P. aeruginosa*

42% for *P. gingivalis*

## Evaluation of the volume of the bacterial biofilm

The study of the bacterial biofilm was carried out in depth thanks to the specific method of confocal laser scanning microscopy<sup>10, 11</sup>, measuring the volume of the biofilm on the Synthegra surface as well as the sand-blasted one.



3D reconstruction of the biofilm on the sandblasted surface (A-C-E) and on Synthegra (B-D-F). The green represents live bacteria, the red is the dead bacteria (I.R.C.C.S. Galeazzi).

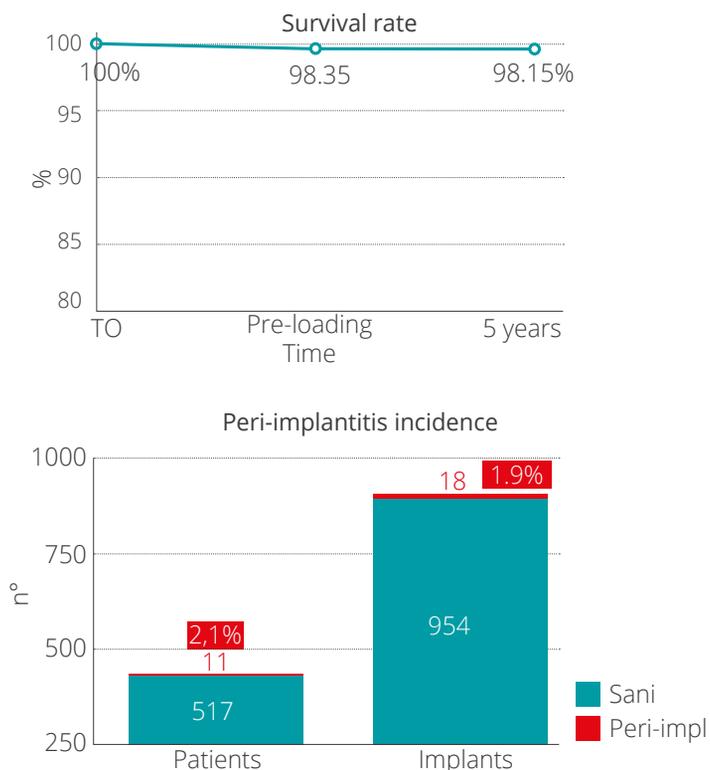
### Results

The measurements carried out indicate, for the three species analysed, a reduced volume of bacterial biofilm on Synthegra compared to the sand-blasted surface.

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

5 years after marketing the implant-prosthesis system way (2008), Geass has decided to gather the clinical data with a retrospective study aimed at evaluating the behaviour of way Milano with the Synthegra surface in the medium term.

The preliminary data confirms 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.

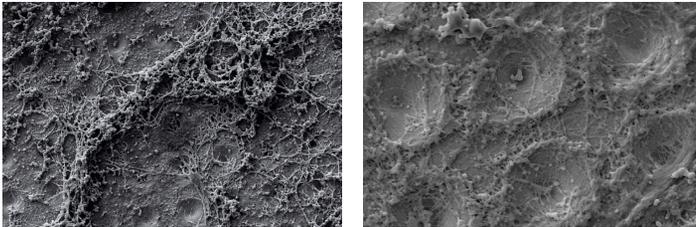
All the edentulia (single, partial and total) and all the prosthetic rehabilitation techniques with prosthetic loading at at least 12 months were considered.

\* The data collection concluded in 2016 and the study is about to be published.

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

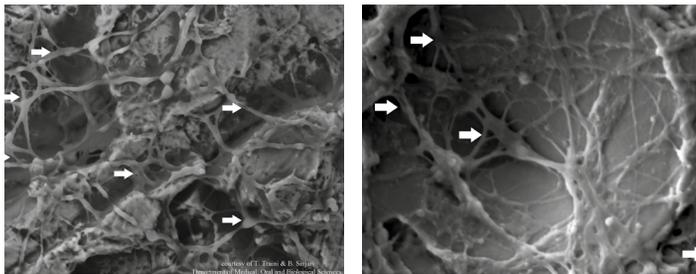
▶ Synthegra behaves like a rough surface: it promotes osseointegration

Synthegra stimulates the formation of a coagulation of the extended **fibrin**, 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<sup>13, 14</sup>.



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

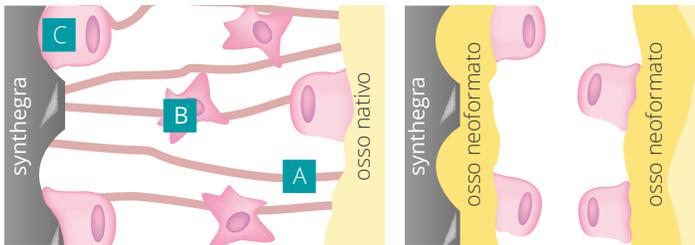
Synthegra

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).

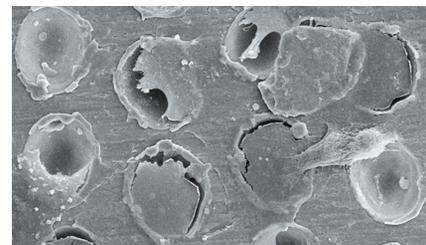


## Greater contact osteogenesis

Thanks to the elevated fibrin adhesion, **Synthegra** 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.



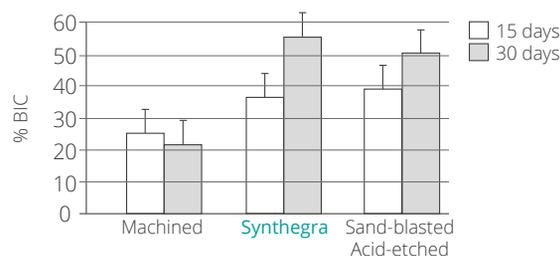
The pre-osteoblasts migrate along the fibrin filaments and reach Synthegra, where they begin to deposit new bone (in dark yellow). The formation of new bone originates both from native bone as well as from Synthegra. A.fibrina - B.pre-osteoblasti - C.osteoblasti



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

## Rapid osseointegration

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



Implants with machined, Synthegra and sand-blasted-acid etched surfaces were inserted into spongious 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 **Synthegra is greater than that of the machined surface** and can be compared to the better performing rough surfaces.

Synthegra, as well as guaranteeing a lesser risk for bacterial adhesion, ensures excellent osseointegration in a short time<sup>15, 16, 17, 18</sup>.

▸ Synthebra  
doubly unique,  
doubly effective

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

1

- an extremely smooth nature
- lesser bacterial adhesion



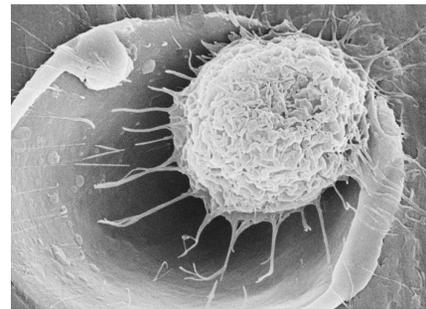
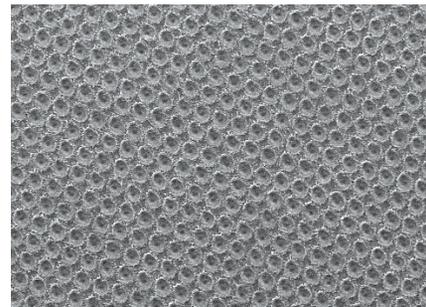
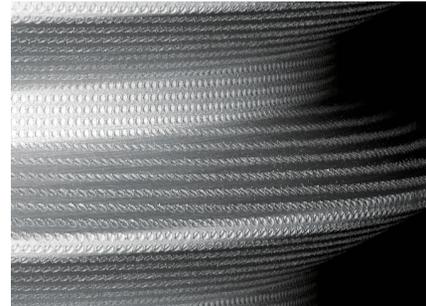
less risk of peri-implant infection

2

- greater adhesion of the fibrin
- greater contact osteogenesis



perfect osseointegration



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

## Bibliography

- <sup>1</sup>Wennerberg A, Albrektsson T. Effects of titanium surface topography on bone integration: a systematic review. *Clin Oral Implants Res.* 2009 Sep;20 Suppl 4:172-84.
- <sup>2</sup>Le Guéhennec L, Soueidan A, Layrolle P, Amouriq Y. Surface treatments of titanium dental implants for rapid osseointegration. *Dent Mater.* 2007 Jul;23(7):844-54.
- <sup>3</sup>Shalabi MM, Gortemaker A, Van't Hof MA, Jansen JA, Creugers NH. Implant surface roughness and bone healing: a systematic review. *J Dent Res.* 2006 Jun;85(6):496-500.
- <sup>4</sup>Mombelli A, Müller N, Cionca N. The epidemiology of peri-implantitis. *Clin Oral Implants Res.* 2012 Oct;23 Suppl 6:67-76.
- <sup>5</sup>Atieh MA, Alsabeeha NH, Faggian CM Jr, Duncan WJ. The frequency of peri-implant diseases: a systematic review and meta-analysis. *J Periodontol.* 2013 Nov; 84(11):1586-98.
- <sup>6</sup>Brevetto nr. 0001373025
- <sup>7</sup>Albrektsson T, Wennerberg A. Oral implant surfaces: Part 1--review focusing on topographic and chemical properties of different surfaces and in vivo responses to them. *Int J Prosthodont.* 2004 Sep-Oct;17(5):536-43.
- <sup>8</sup>Astrand P, Engquist B, Anzén B, Bergendal T, Hallman M, Karlsson U, Kvint S, Lysell L, Rundcranz T. A three-year follow-up report of a comparative study of ITI Dental Implants and Brånemark System implants in the treatment of the partially edentulous maxilla. *Clin Implant Dent Relat Res.* 2004;6(3):130-41.
- <sup>9</sup>Drago L, Bortolin M, De Vecchi E, Agrappi S, Weinstein RL, Mattina R, Francetti L. Antibiofilm activity of sandblasted and laser-modified titanium against microorganisms isolated from peri-implantitis lesions. *Journal of Chemotherapy, In Press*, doi: 10.1080/1120009X.2016.1158489.
- <sup>10</sup>Christensen GD, Simpson WA, Younger JJ, Baddour LM, Barrett FF, Melton DM, et al. Adherence of coagulase-negative staphylococci to plastic tissue culture plates: a quantitative model for the adherence of staphylococci to medical devices. *J Clin Microbiol.* 1985;22:996-1006.
- <sup>11</sup>Drago L, Del Fabbro M, Bortolin M, Vassena C, De Vecchi E, Taschieri S. Biofilm removal and antimicrobial activity of two different air-polishing powders: an in vitro study. *J Periodontol.* 2014;85:363-369.
- <sup>12</sup>Vassena C, Fenu S, Giuliani F, Fantetti L, Roncucci G, Simonutti G, et al. Photodynamic antibacterial and antibiofilm activity of RLP068/Cl against *Staphylococcus aureus* and *Pseudomonas aeruginosa* forming biofilms on prosthetic material. *Int J Antimicrob Agents.* 2014;44:47-55.
- <sup>13</sup>Cei S, Legitimo A, Barachini S, Consolini R, Sammartino G, Mattii L, Gabriele M, Graziani F. Effect of Laser Micromachining of Titanium on Viability and Responsiveness of Osteoblast-Like Cells. *Implant Dent.* 2011 Aug;20(4):285-91.
- <sup>14</sup>Berardi D, De Benedittis S, Polimeni A, Malagola C, Cassinelli C, Perfetti G. In vitro evaluation of the efficacy of a new laser surface implant: cellular adhesion and alkaline phosphatase production tests. *Int. J. Immunop. Pharm.* 2009; 1;125-131.
- <sup>15</sup>Lepore S, Milillo L, Trotta T, Castellani S, Porro C, Panaro MA, Santarelli A, Bambini F, Lo Muzio L, Conese M, Maffione AB. Adhesion and growth of osteoblast-like cells on laser-engineered porous titanium surface-Expression and localization of N-cadherin and  $\beta$ -catenin. *J Biol Regul Homeost Agents.* 2013 Apr-Jun;27(2):531-41.
- <sup>16</sup>Leonida A, Redondo J, Todeschini G, Rossi G, Paiusco A, Baldoni M. Valutazione del grado di differenziamento in senso osteoblastico delle cellule staminali mesenchimali umane su una superficie in titanio modificata al laser. *Quintessenza Internazionale & International Journal of Oral & Maxillofacial Implants*, 2013;29:1bis;23-28.
- <sup>17</sup>Sinjari B, Guarnieri S, Diomede F, Merciaro I, Mariggio MA, Caputi S, Trubiani O. Influence of titanium laser surface geometry on proliferation and on morphological features of human mandibular primary osteoblasts. *J Biol Regul Homeost Agents.* 2012 Jul-Sep;26(3):505-13.
- <sup>18</sup>Berardi D, De Benedittis S, Scoccia A, Perfetti G, Conti P. New laser-treated implant surfaces: A histologic and histomorphometric pilot study in rabbits. *Clin Invest Med.* 2011 Aug 1;34(4):E202.

# Synthegra and the implants Geass

Synthegra is the surface treatment applied to the implant-prosthetic systems designed by Geass.

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