synthegra

The surface which fights peri-implantitis
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.

The most recent data (Mombelli 2012) states that this problem concerns about 20% of patients and 10% of implants\(^4\), 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.
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.

According to the classification of the surfaces of Albrektsson and Wennerberg, 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.

<table>
<thead>
<tr>
<th>Roughness (Ra)</th>
<th>Definition</th>
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<tbody>
<tr>
<td>≤ 0.4 μm</td>
<td>smooth</td>
</tr>
<tr>
<td>0.5 - 1.0 μm</td>
<td>machined</td>
</tr>
<tr>
<td>1.0 - 2.0 μm</td>
<td>moderately rough</td>
</tr>
<tr>
<td>&gt; 2.0 μm</td>
<td>rough</td>
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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\(^9\).

**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\(^{10}\). Data expressed as average absorbance at 595 nm ± SD. *** P < 0.001 (I.R.C.C.S. Galeazzi).

![Graph showing the quantity of biofilm on Synthegra versus sand-blasted surface.](image)

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\(^{10,11}\), measuring the volume of the biofilm on the Synthegra surface as well as the sand-blasted one.

3D reconstruction of the biofilm on the sanblasted 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).

![3D images of biofilm reconstruction](image)

**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*.

![Survival rate graph](image)

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 least 12 months were considered.

![Peri-implantitis incidence graph](image)

* 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\textsuperscript{13,14}.

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.

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.

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).

Synthegra, as well as guaranteeing a lesser risk for bacterial adhesion, ensures excellent osseointegration in a short time\textsuperscript{15, 16, 17, 18}.

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 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.
Bibliography

6. Brevetto nr. 0001373025
Syntheegra and the implants Geass

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

Way
Six types of implant, specific for every kind of rehabilitation, connected by the same surgical protocol. Way is the perfect solution to answer all the professional’s needs.

Way Milano
Way Roma
Way Venezia
Way Extra
Way Short
Way Slim
Esthetic area
Distal area
Great rehabilitations
Post extraction
5 and 6.5 mm
Ø 3 mm

Omny
The implant system which reconciles the clinical needs and the limited economic base of the patients, thanks to simple, complete, innovative and cost-effective solutions.