

ACTILINK[®]

IMPLANTOLOGY

Proven Performance with Freedom



***plasmapp**

ACTILINK, Trusted Safeguard for dental implant and materials in dental implantology

Novel plasma technology for outstanding performance



Improving
Osseointegration



Clean
Surface



Switchable
Plasma Mode



Simple
Operation

Implant Fixture

Enhanced osseointegration

Abutment

Enhanced tissue integration

Materials

Enhanced biocompatibility

Prosthesis

Enhanced safety



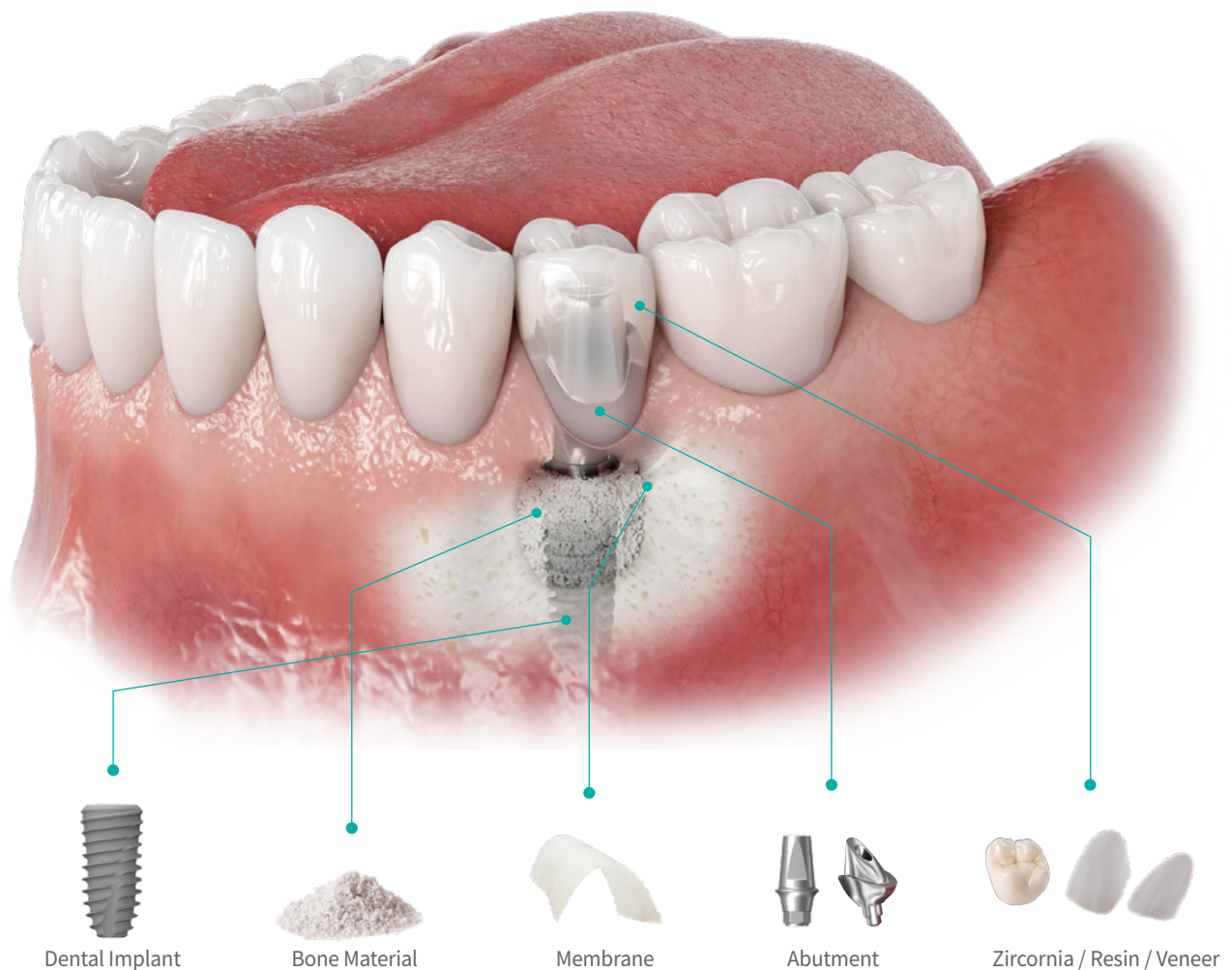
ACTILINK *Reborn*

Vacuum plasma activator for professional dental implantology

Model	ACTILINK reborn
Size (W x H x D)	170 x 345 x 266 (unit: mm)
Weight	6 kg
Cycle Time	60 seconds

Proven Performance with Freedom

Plasmapp ACTILINK introduces cutting-edge technology, DIRECT Plasma & VOLTEX Plasma, designed to enhance the safety, performance, and flexibility of choice for all implant systems



ACTILINK *Reborn*

Vacuum plasma activator for professional dental implantology

DIRECT PLASMA
(mode)



Implant
Holder

[Open Type]

for All implant system

VORTEX PLASMA
(mode)



Ampule
Holder

[Close Type]

Customized
for any implant brands

Material
Holder

[Open Type]

for All
dental materials

DIRECT PLASMA

Outstanding performance for any implant system

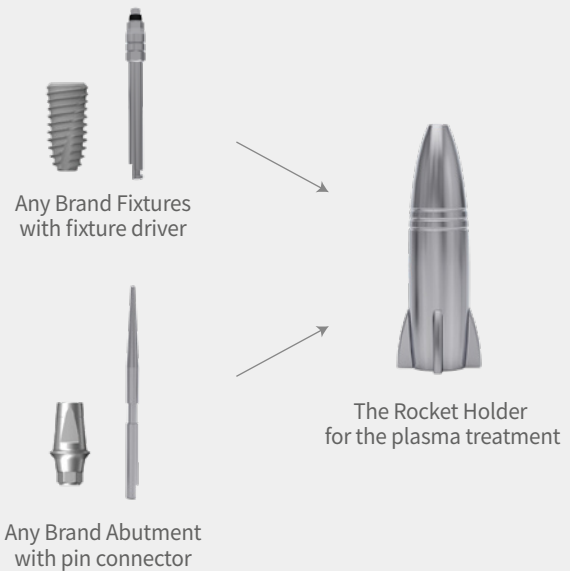
In very challenging treatment protocols and patients with compromised health



[Open Type]

Implant Holder

for Any implant system



The DIRECT plasma mode offers a faster and more efficient method for eliminating surface contaminants.



ACCESSORY Kit for Direct Plasma



DIRECT plasma mode

Purple Color LED

Hold the button to power on for the selection of modes
*Check the manual for more information.

VORTEX PLASMA

Every indication and every need

Uncompromised cleanness for any materials in dental implantology

[Open Type]

Material Holder

for All dental materials



Abutment



Zirconia / Resin / Veneer



ADM / Membrane



Bone Material



Fiber Post

Material holder enables plasma treatment with various type of dental materials

[Close Type]

Ampule Holder

Customized for any implant brands



28 Brand Ampule Libraries

Osstem	Dio	Sweden & Martina	Warantec	iRes
Dentium	Neobiotech	IBS	ACH	TRI
Straumann	Dentis	Bredent	Cybermed	BEGO
Zimmer	Megagen	Biotem	Oneday	AB Dental
Astra	MIS	Cowelmedi	Withwell	Callus
Nobel Biocare	Bio Horizons	SIC	Toplan	Neoss

Ampule holder enables plasma treatment with the manufacturer's ampoule itself for maximum ease of use

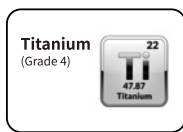


VORTEX plasma mode

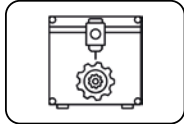
Blue Color LED

Hold the button to power on for the selection of modes
*Check the manual for more information.

Impurity property change during implant manufacturing process



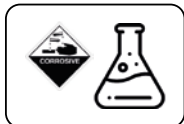
Material



CNC Machining



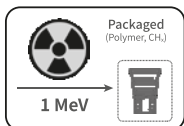
Sand Blasting



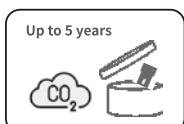
Acid-Etching



Cleaning



Sterilization



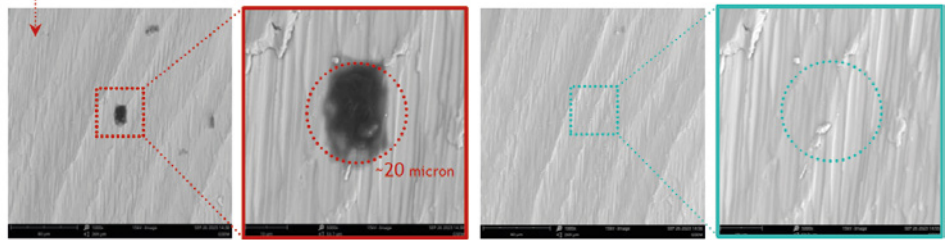
Shelf Life



Implant Surgery

CNC Machining & Cleaning

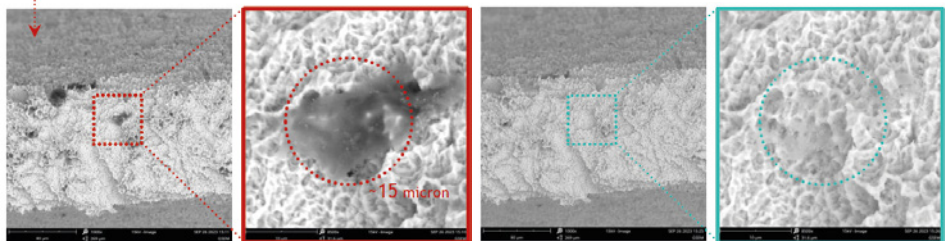
C1s in XPS spectrum: 53%



Micron-sized impurities on the machined surface are completely removed by the ACTILINK treatment.

SLA surface treatment

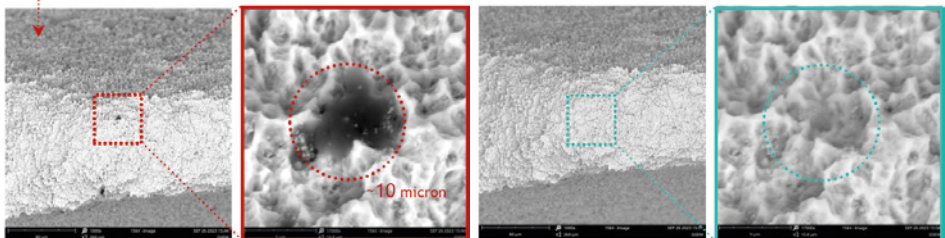
C1s in XPS spectrum: 47%



Number of micron-sized impurities are increased by the SLA treatment, and most of the impurities are removed by the ACTILINK treatment.

Chemical Cleaning

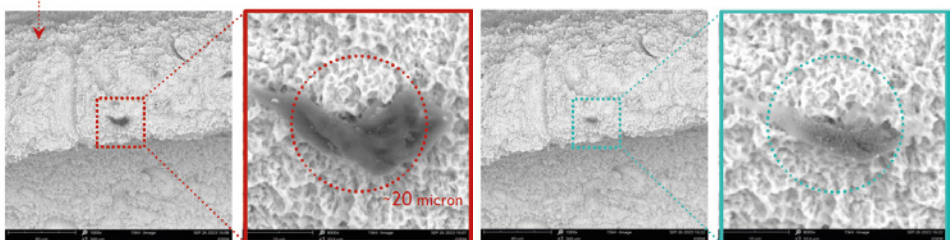
C1s in XPS spectrum: 28%



The impurities are reduced by the cleaning process, and most of the impurities are removed by the ACTILINK treatment. It implies the binding energy of impurity is increased by the micro-roughness.

After sterilization and shelf life

C1s in XPS spectrum: 30~40%



The impurities are increased by the sterilization process and during the long shelf life, but most impurities are removed by the plasma treatment even though the binding energy is increased by Gamma ray during the sterilization process.

Why the activation process is required

One of the Main Risks with Dental implant systems is the implant body failure (connection with bone)

Benefits and Risks

Dental implants can significantly improve the quality of life and the health of a person who needs them.

However, complications may sometimes occur. Complications can occur soon after dental implant placement or much later.

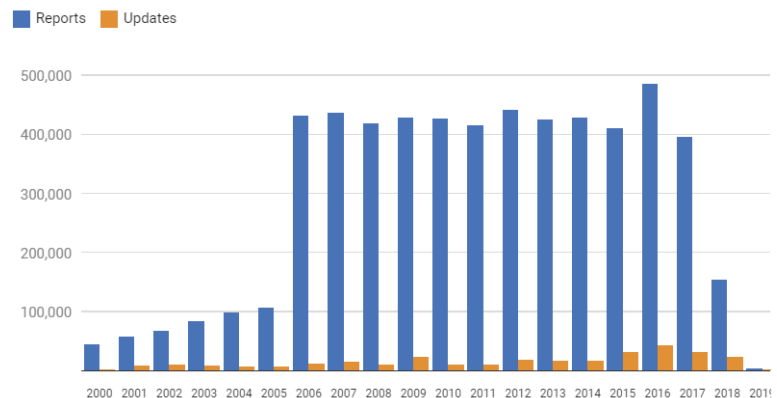
Some complications result in implant failure (usually defined as implant looseness or loss). Implant failure can result in the need for another surgical procedure to fix or replace the implant system.

“

This kind of implant goes into the bone to support an artificial tooth or implant.

Many of the reports were for problems with connections between the device and the bone.

”



Romanian Journal of Oral Rehabilitation | Vol.8, No.2, April - June 2016

Quality assessment of dental implants under aspects of SEM and EDX analysis - A comparison of five one-piece implants

Dirk U. Dudeck DDS ^{1,2}

¹ Charite - University Medicine Berlin, Campus Benjamin Franklin - Department of Prosthodontics

² mmri.berlin - The Medical Materials Research Institute, Berlin

The implant body failure (peri-implantitis, bone resorption, etc.) may be resulted by contamination.

ScienceDirect | Acta Biomaterialia 5 (2009) 2222-2229

XPS, AES and SEM analysis of recent dental implants

Byung-Soo Kang ^a, Young-Taeg Sul ^a, Se-Jung Oh ^b, Hyun-Ju Lee ^c, Tomas Albrektsson ^a

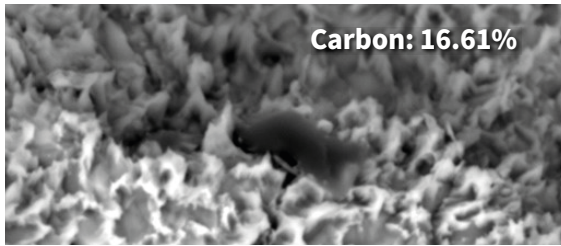
^a Department of Biomaterials/Handicap Research, Institute for Clinical Sciences, The Sahlgrenska Academy at Gothenburg University, Box 412, SE 405 30, Gothenburg, Sweden

^b Department of Physics and Astronomy, Seoul National University, Seoul, South Korea

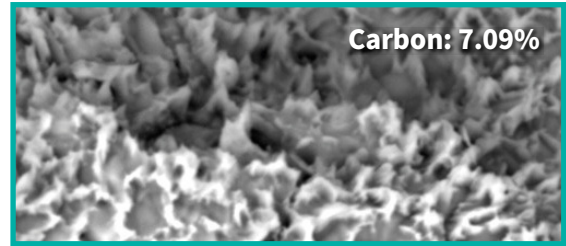
^c National Center for Inter-University Research Facility, Seoul National University, Seoul, South Korea

Carbon is the main contamination of various implant systems whose concentration from 32% to 53%.

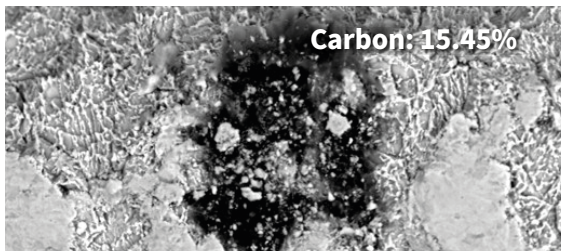
Performance test to remove impurities on implant surface



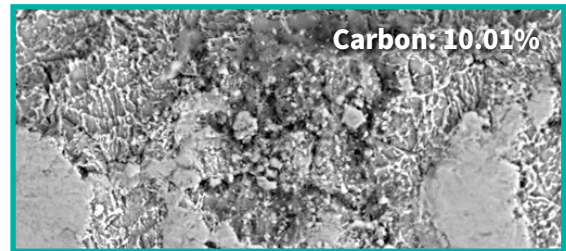
Before the Treatment



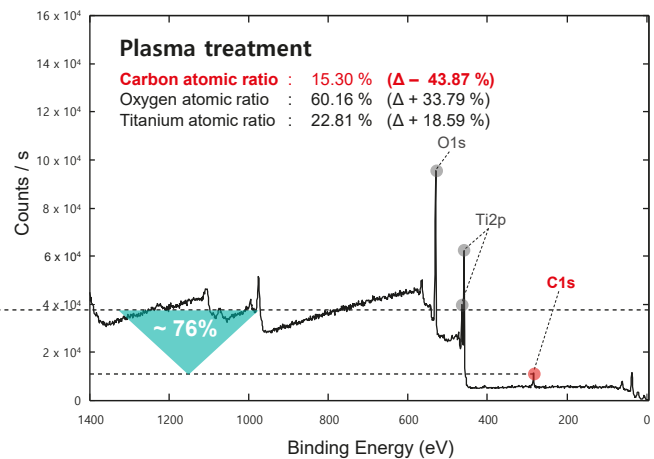
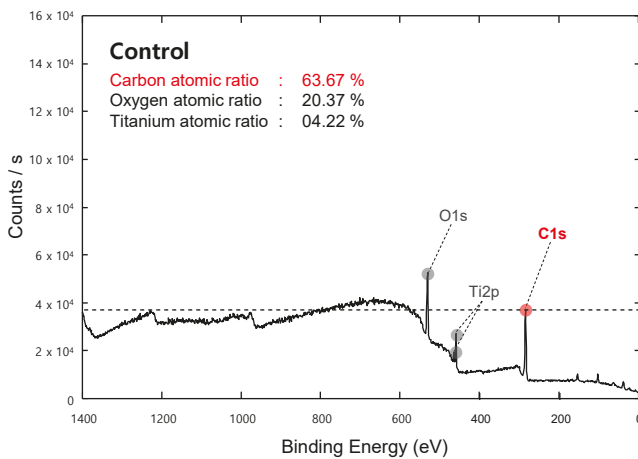
After the Treatment



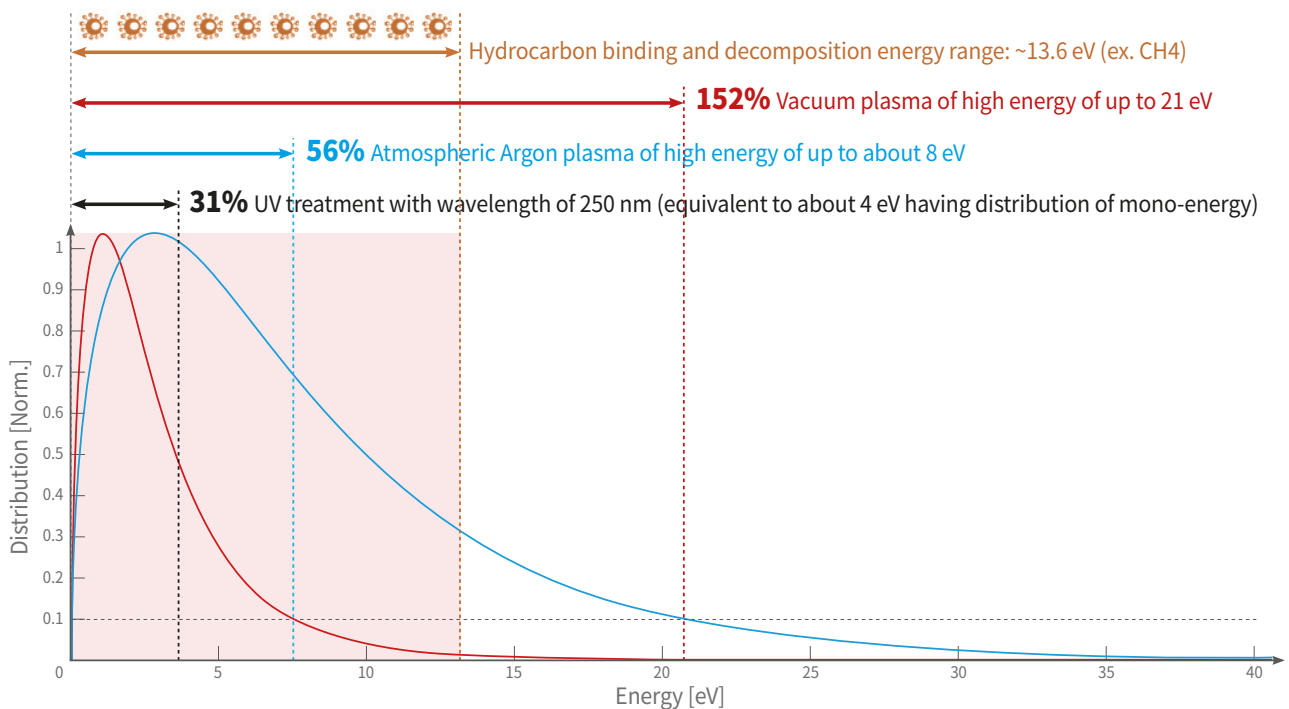
Before the Treatment



After the Treatment



High energy vacuum plasma for maximizing performance



Impurity property change during implant manufacturing process

Surface binding energy of the impurities is significantly increased by the Rough surface and Gamma sterilization of the implant fixture, and ONLY plasma treatment utilizing high energy level can substantial impurity removal performance and clinical effectiveness.

Comparative analysis

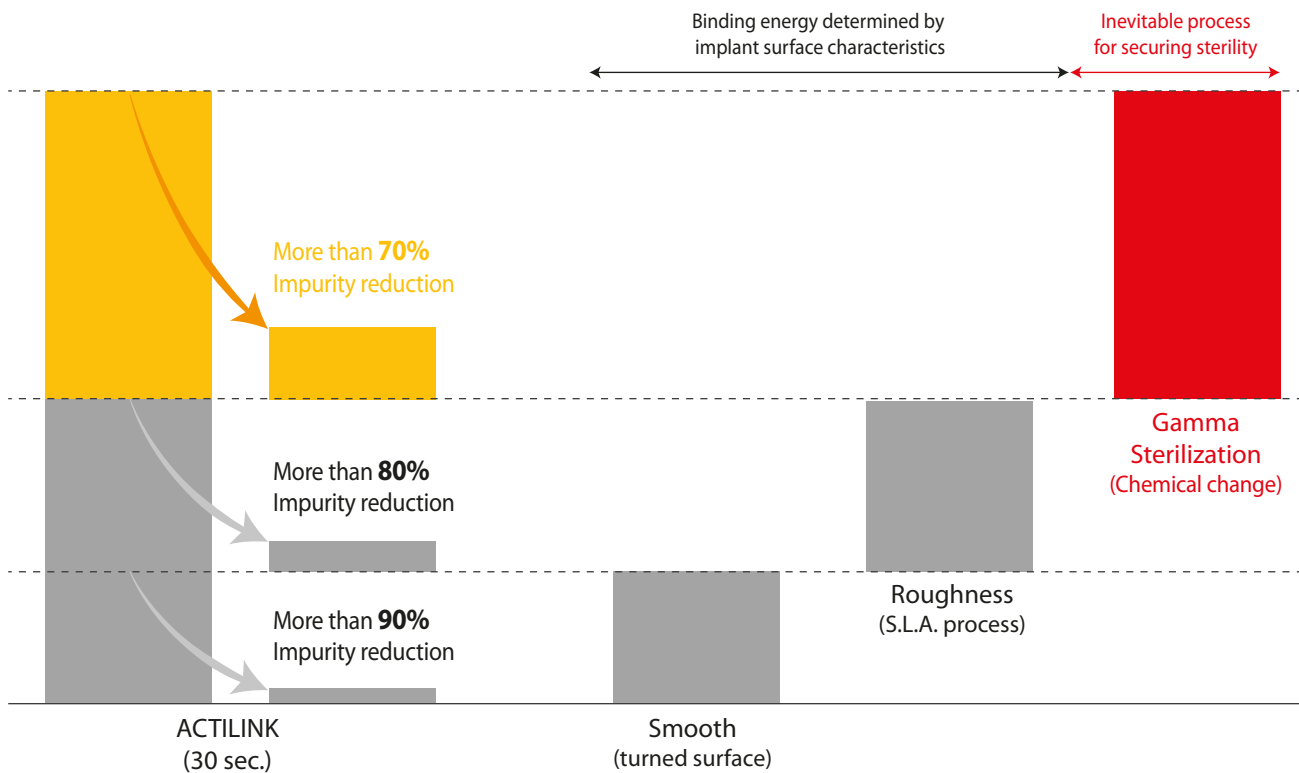
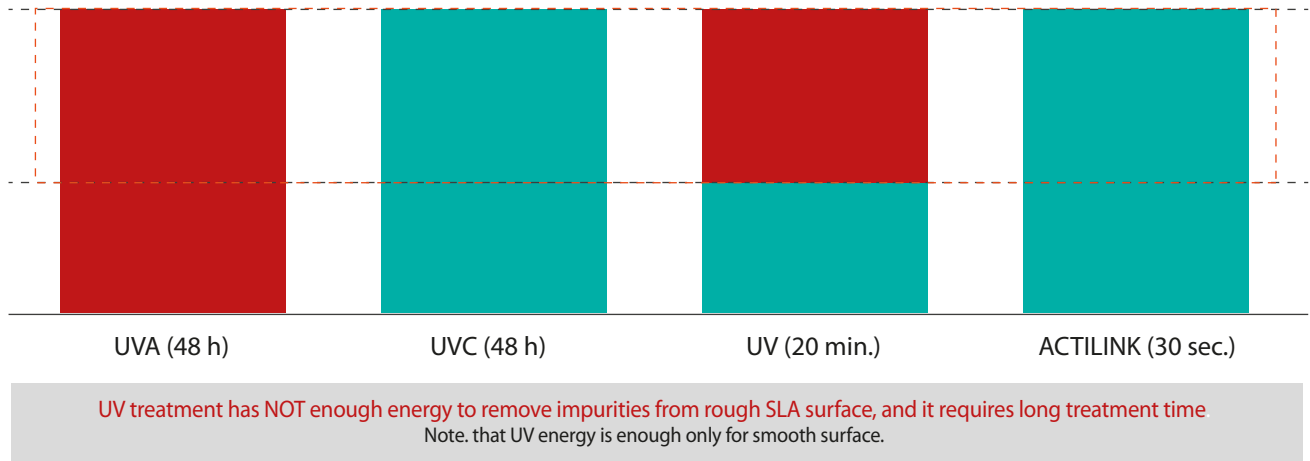
1. UV treatment (UVA vs. UVC)

- Effectiveness: Carbon level reduction
- Target: SLA Coupon (without Gamma)

2. UV vs. Plasma treatment

- Effectiveness: Fibroblast cell activity
- Target: Machined and SLA Coupon (Without Gamma)

NOT Effective Effective

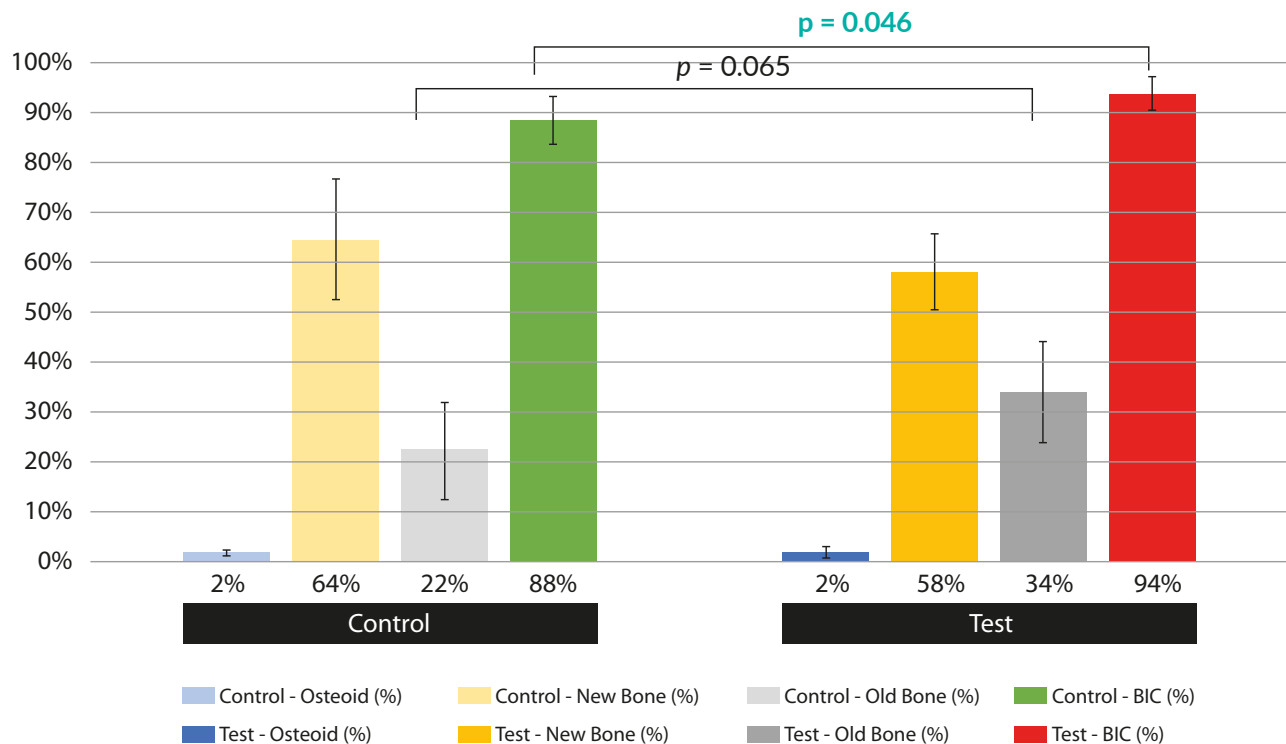


Gamma sterilization method is very effective for securing sterility, but it is NOT good for obtaining clean surface. Gamma increases binding energy of impurities on implant surface.

Note. that Gamma makes additional contamination with molecules from package material

Pre-clinical test improved osseointegration performance

Bone to Implant Contact (4 weeks)



Histology Figure (4 weeks)

Total BIC (Bone to implant contact): 93.7%
 = Osteoid (1.8%) + New bone (58.0%) + Old bone (33.9%)

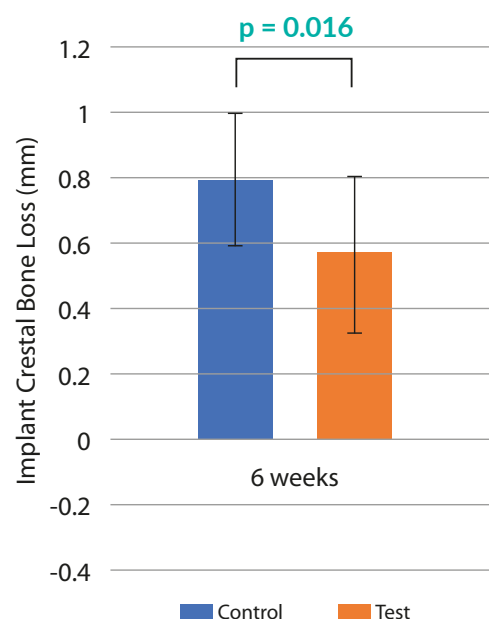


Control

After Treated

Bone Loss (6 weeks)

Bone loss was reduced in the Test group compared to the Control group after 6 weeks



※ Comparison of Bone-to-Implant Contact results between control and plasma treated groups after 2 weeks and 4 weeks.
 (T-test significant difference at 4 weeks * $p < 0.05$.)

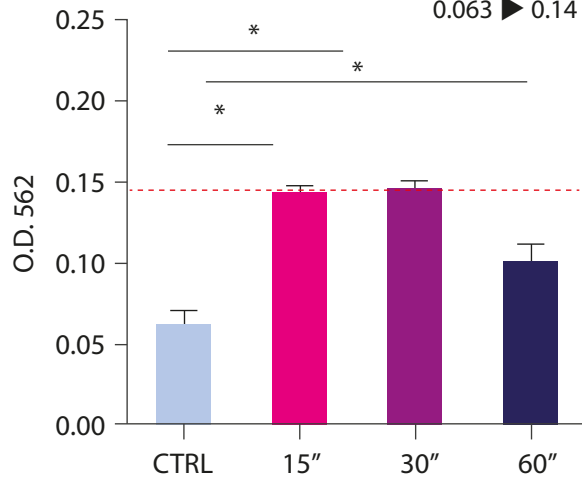
※ 2023 Perio Implant Research Inc. (October 5, 2023)

Enhance fibroblast activity test on titanium surface

Machined Surface

Initial protein adsorption **127% Enhanced**

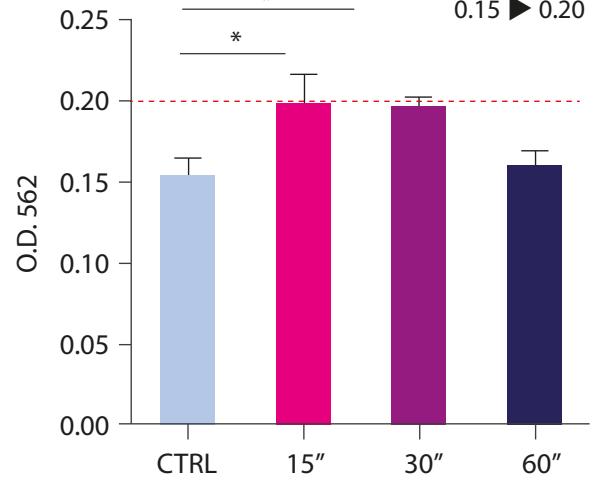
0.063 ► 0.14



S.L.A. Surface

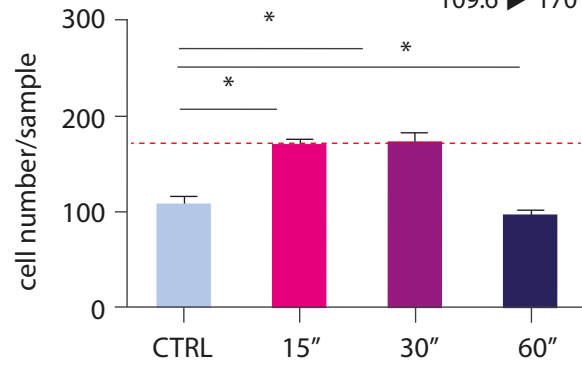
Initial protein adsorption **29% Enhanced**

0.15 ► 0.20



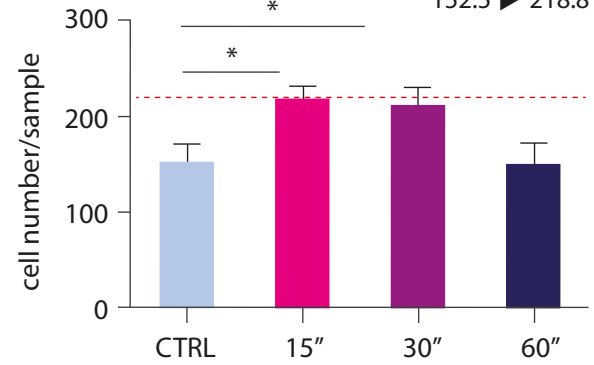
Fibroblast cell adhesion **55% Enhanced**

109.6 ► 170



Fibroblast cell adhesion **43% Enhanced**

152.5 ► 218.8



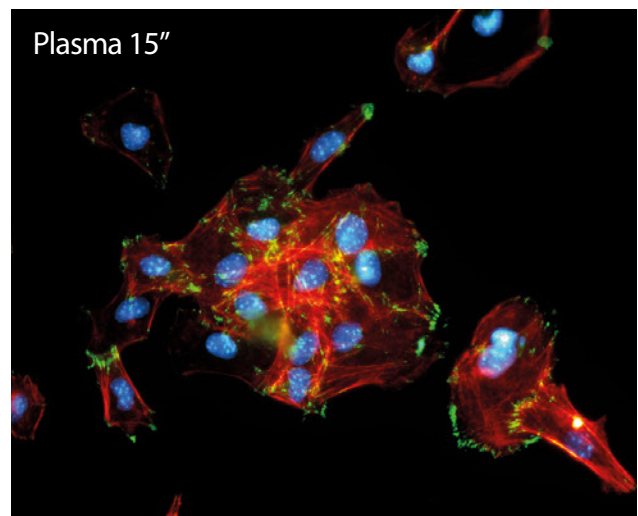
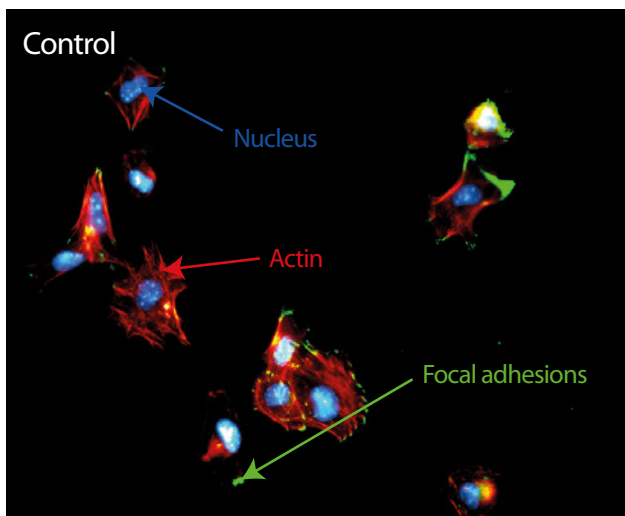
Control

Plasma 15 sec.

Plasma 30 sec.

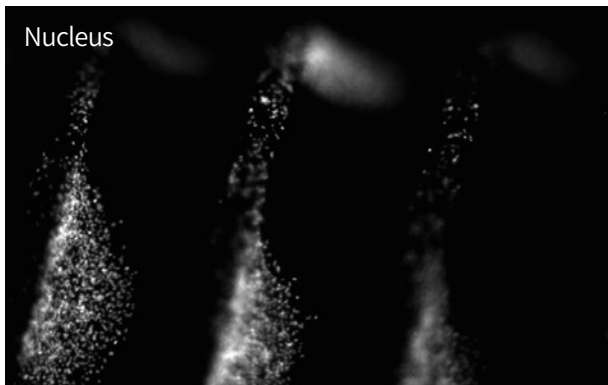
Plasma 60 sec.

Cell morphology

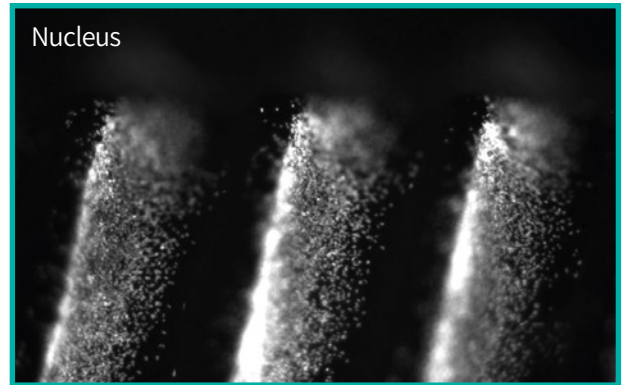


The cells were stained for the nucleus (DAPI, blue), the actin (rhodamine-phalloidin, red) and the focal adhesions (paxillin, green).

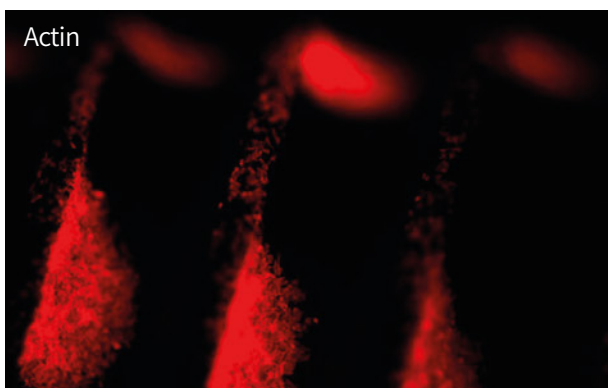
In vitro test showing enhanced osteoblast cell activity



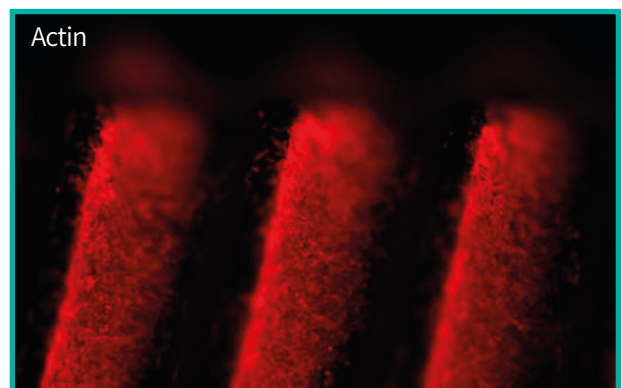
Control



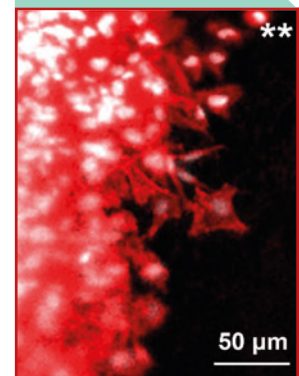
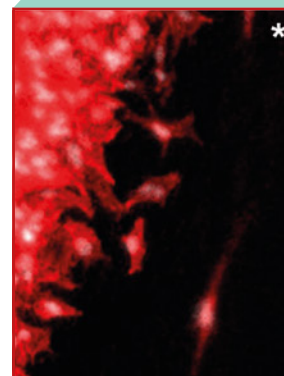
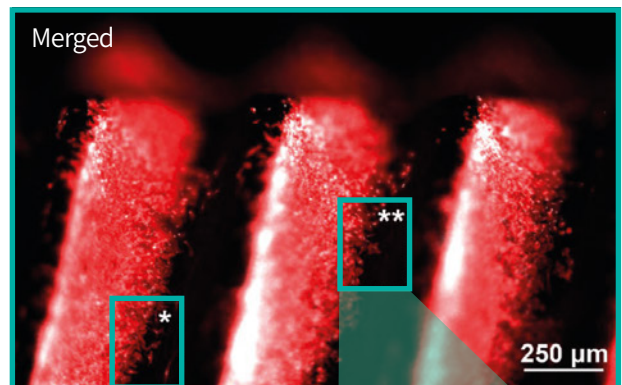
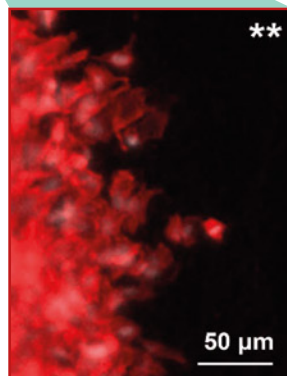
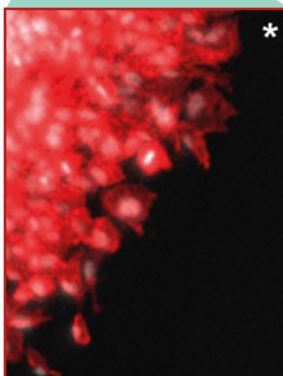
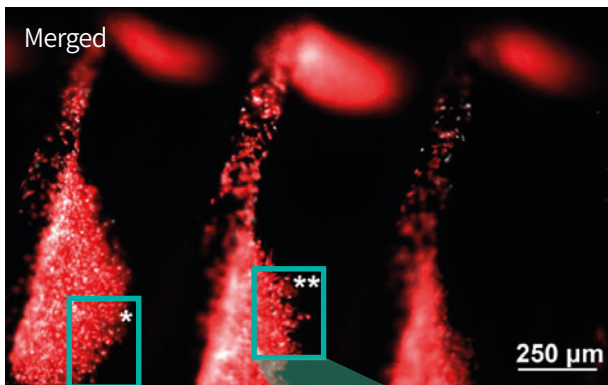
After Treated



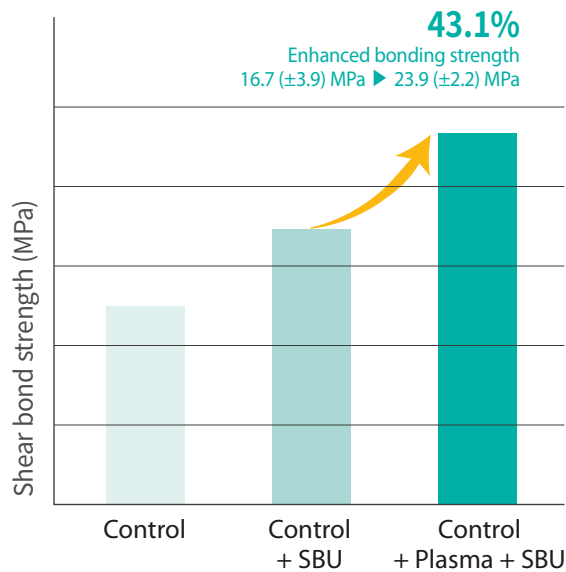
Control



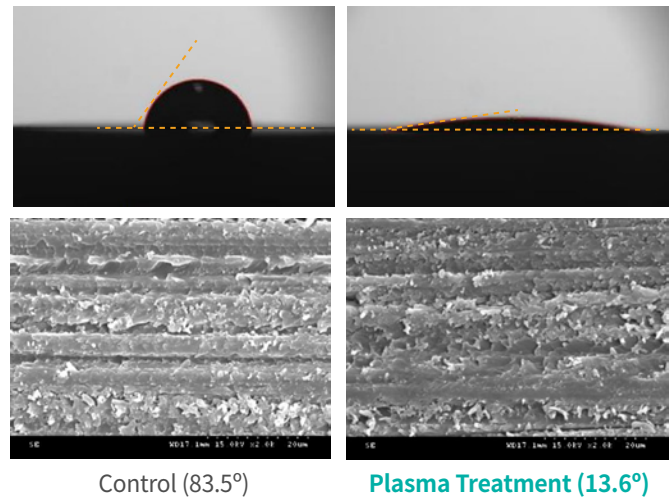
After Treated



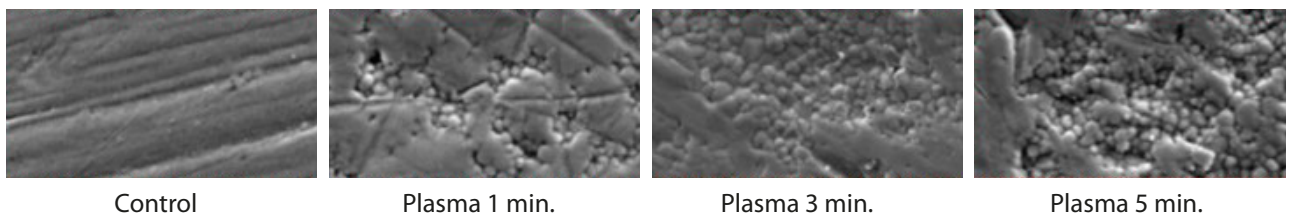
Uncompromised cleanness for any material in dental implantology



Zirconia contact angle test (hydrophilicity enhanced)

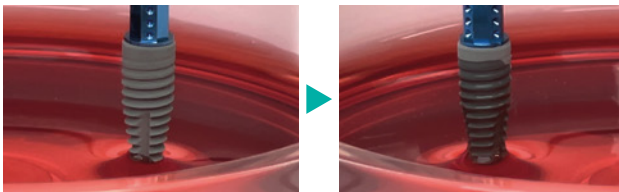


To obtain hydrophilic property with final structure of roughness



Hydrophilicity test for various device and materials used on medical applications

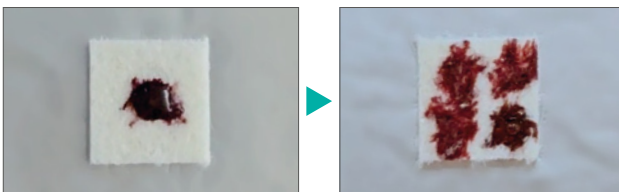
Implant Fixture



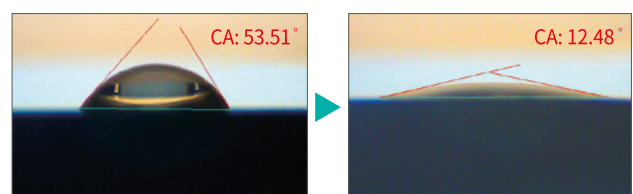
Bone Material



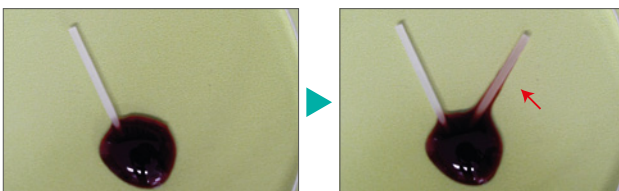
Membrane & ADM



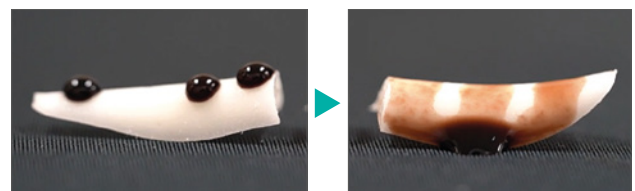
Zirconia & Resin



Fiber Post

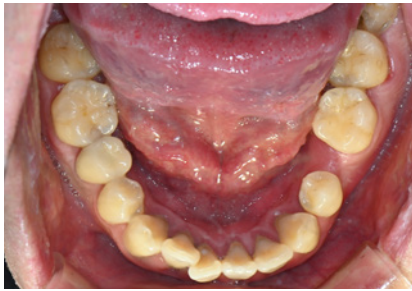


Silicone

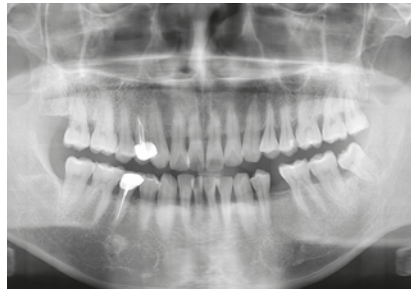


Clinical Cases

Prosthesis - A single case of Implantium on the #35



Pre-op



Pre-op



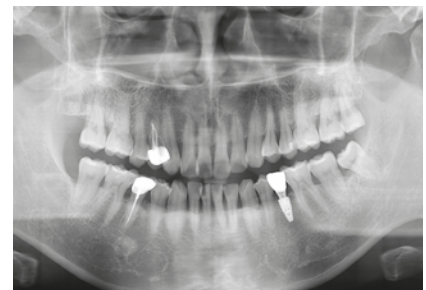
Post-op
Fixture Plasma Activation



Post-op



Final Prosthesis
Prosthetic Plasma Activation

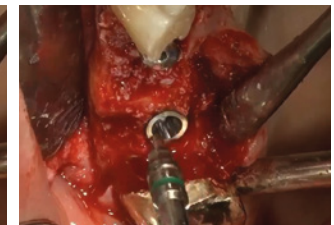
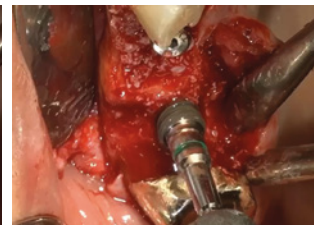
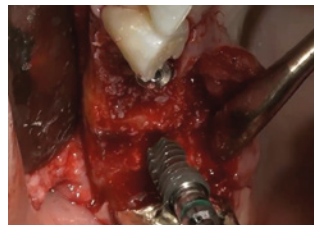


Final Panorama

Implantation - Improved osseointegration



Total cycle time: 1 min

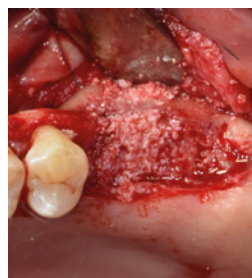


Improved implantation with hydrophilic property

Membrane for GBR – improved tissue integration



Total cycle time: 1 min



Bone graft



Membrane





Gas Plasma Treatment Improves Titanium Dental Implant Osseointegration - A Preclinical In Vivo Experimental Study

Myron Nevins · Chia-Yu Chen · Stephano Parma-Benfenati · David M. Kim

Result & Discussion

In conclusion, this preclinical study underscored the potential of nonthermal plasma treatment in enhancing dental implant osseointegration. Despite a small sample size, the plasma-treated implants demonstrated superior osseointegration and reduced vertical bone loss, suggesting the potential for shorter healing times before proceeding with prosthetic loading and improved long-term stability. While further research is needed to validate and optimize this treatment, these findings highlight its promising clinical significance in potentially improving patient outcomes in dental implant therapy.



241718R (Control)

241688L (Test)

Dental implant surface properties, such as chemical composition, electrical charge, roughness, surface energy, morphology, and wettability, play an important role in determining the cascade of biological events that allow osseointegration [4]. Dental implant surface treatments, such as plasma spray, laser treatment, acid etching, anodizing, nanoparticle depositions, and sand blasting, followed by acid etching have all allowed for faster osseointegration and reduction in loading time [4]. The results showed that plasma treatment did not significantly affect the implant torque value (ITV) and implant stability quotient (ISQ) at the time of implant insertion. We decided not to measure ISQ during the observation period in order to avoid disrupting the osseointegration process. The radiographic bone level during the early osseointegration stages (2 and 4 weeks) was comparable; however, at the 6-week mark, the plasma-treated group showed significantly higher radiographic bone levels than the non-plasma-treated control group. Our results further substantiate findings from previous in vitro studies that have reported the beneficial effects of plasma treatment on dental implants. Duske et al. reported that cold atmospheric plasma treatment reduced contact angle and supported the spreading of osteoblastic cells; furthermore, the treatment effectively removed the biofilm [28,29]. Berger et al. demonstrated that a benchtop plasma treatment at the time of implant placement could alter the surface energy of an

implant without modifying the chemical composition and enhance osteoblast cell differentiation [20]. Lee et al. have conducted extensive in vitro studies, such as hydrocarbon contamination analysis, protein adsorption assay, cell proliferation assay, cell differentiation assay, and scanning electron microscope (SEM) analysis, to examine the effect of plasma treatment on dental implants [19]. With SEM analysis, there was no noticeable difference between the conditions of the sandblast large grit acid-etched surface before and after the plasma treatment in terms of cracking or corrosion sites. Their study revealed a 58% reduction of hydrocarbons, a 25% increase in protein adsorption, a 39% increase in cell attachment to the implant surface, and an 82% increase in alkaline phosphatase activity. Their results indicate that plasma treatment efficiently eliminates the hydrocarbon, enhancing protein adsorption and improving cell adhesion, proliferation, and differentiation.

	Control (Mean ± SD)	Test (Mean ± SD)	p-Value
Osteoid (%)			
2 weeks	2.2 ± 1.0%	3.6 ± 0.5%	0.366
4 weeks	1.7 ± 0.5%	1.8 ± 1.1%	0.853
6 weeks	1.8 ± 1.0%	1.1 ± 0.2%	0.224
New bone (%)			
2 weeks	57.7 ± 7.7%	62.8 ± 8.3%	0.316
4 weeks	64.4 ± 12%	58.0 ± 7.6%	0.292
6 weeks	71.4 ± 10.1%	73.4 ± 5.3%	0.914
Old bone (%)			
2 weeks	16.8 ± 10.8%	15.0 ± 7.7%	0.765
4 weeks	22.1 ± 9.7%	33.9 ± 10.1%	0.065
6 weeks	10.3 ± 4.7%	14.4 ± 6.8%	0.326
BIC (%)			
2 weeks	76.7 ± 11.0%	81.4 ± 6.9%	0.428
4 weeks	88.3 ± 4.8%	93.7 ± 3.3%	0.046
6 weeks	83.5 ± 10.2%	88.9 ± 4.8%	0.284

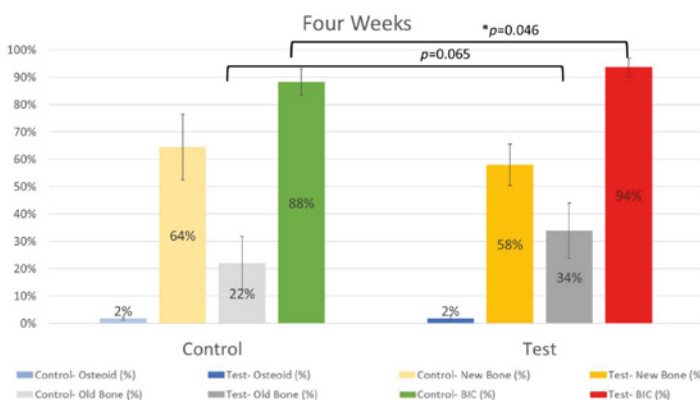


Table 1. Statistical analysis demonstrating a significant difference in BIC between control and test implants at week 4.

Figure 8. Representative histology images from control and test implants for each evaluation time point (2 weeks, 4 weeks, and 6 weeks). Histomorphometric analysis examined osteoid %, new bone %, old bone %, and BIC % (* symbolizes statistical significance).

Vacuum plasma treatment device to enhance fibroblast activity on machined and rough titanium surface

Canullo Luigi · Genova Tullio · Chinigò Giorgia · Roberta Iacono · Paolo Pesce · Maria Menini · Mussano Federico

Discussion

This new plasma surface treatment device generates vacuum by removing 99% of atmospheric gasses to obtain an optimized condition for discharging plasma, and this device has been used for implant fixtures to have enhanced osteoblast activity and im-proved osseointegration performance [23,24].

As already demonstrated, plasma bioactivation is able to determine an increase in the surface energy of the abutment and consequently reduce contact angle, enhance the wet-tability and make the surface more hydrophilic. Surface wettability, by improving the in-teraction with the blood clot, increases protein adsorption, such as fibronectin and vitron-ectin, with a positive effect on cellular adhesion, spreading and proliferation [18, 20,21,22].

This study also showed that fibroblast adhesion is significantly increased after Plasma treatment for 15 and 30 seconds in both samples in the early stages of wound healing (20 minutes after treatment), but also that the statistical difference with the negative control group tends to flatten out after 24 hours. The bio-efficacy of the plasma, appreciable both with the trend of protein absorption and cell adhesion, disappears after 24 h due to the saturation effect, because of the diameter of the titanium disk. The present results are con-sistent with other studies and suggest that plasma bioactivation induces a stronger fibro-blast adhesion on abutment surfaces even in the initial stages of the treatment [15, 18]. The clinical advantage of bioactivation is not only a quantitative one, related to a greater number of adherent cells, but also a qualitative one. The latter is due to the morphology of the adhered cells, as it can be seen from the SEM images, while in the control group a flat arrangement is observed, in the bioactivated samples a spread arrangement is shown. One possible speculation is that, together with the qualitative and quantitative increase, the cell is being driven by three-dimensional geometry towards faster differentiation. This results in better cell / abutment integration, as confirmed already by Canullo et al. 2021, even in the initial phase [36].

This study further confirmed the efficacy of plasma treatment. The advantage of the plas-ma device studied in this manuscript is the reduced action time required. In the previous-ly analyzed devices, active effect of plasma was generated after 12 min and using addi-tional processing gas of argon. It is important to emphasize that the tested plasma device provides its maximum effect with the plasma treatment for 15-30 sec. Based on the find-ings from previous studies, plasma treatment can chemically modify metal surfaces [40]. Analyses, such as EDS and AFM, have demonstrated the effectiveness of plasma treat-ment in eliminating organic contaminants and oxidizing the metal surface [20,21,22, 40]. Therefore, we assumed that there is an optimal range of these cleaning and oxidation process that enhances protein adsorption and cell adhesion. As indicated by our results, exceeding this optimal threshold may result in counterproductive effects, underscoring the significance of identifying the ideal treatment conditions to attain the desired out-comes. Moreover, for the first time, a vacuum plasma treatment device not fueled by argon gas was used. Therefore, this device represents a clear practical advantage not only in terms of “clinical” time but also in terms of safety regulation. In fact, a rigid bureaucracy regulates the use of this noble gas.

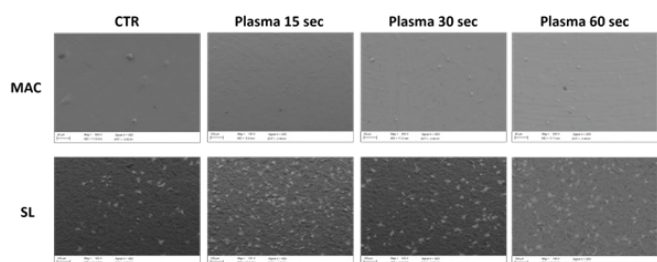
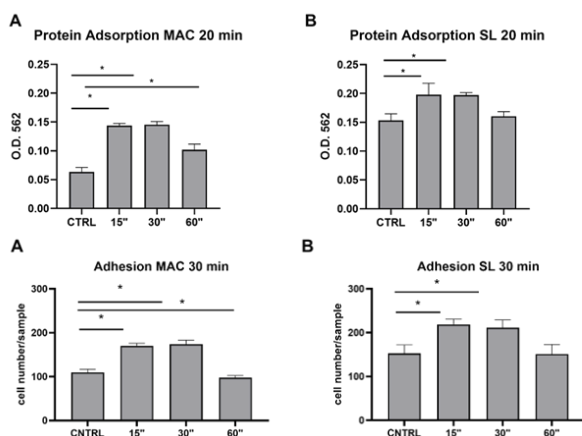


Figure 7. Representative pictures post-op conditions of discs with cell growth at different timepoints. Quantitatively significant differences can be detected between control and bio-active surfaces.

Figure 3. Protein Adsorption was evaluated on MAC and SL samples at 20 min and 4h and Plasma treatment for 15, 30 and 60 seconds. The level of protein adsorption was evaluated using BAC assay. Values represent mean $\pm$ SEM. The symbol (*) indicates the statistical significance vs CTRL surface considering a p value <0,05.

Figure 4. Cell adhesion was evaluated on MAC and SL samples at 30 min and 4h Plasma treatment for 15, 30 and 60 seconds. The level of cell adhesion was measured counting the number of adherent cells for each field. Values represent mean $\pm$ SEM. The symbol (*) indicates the statistical significance vs CTRL surface considering a p value <0,05.



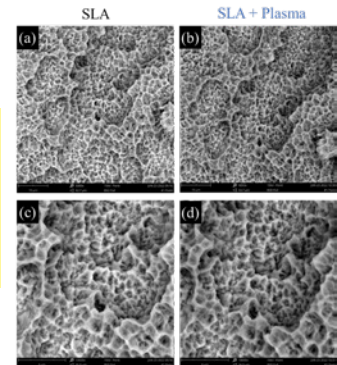
Improvement of osseointegration efficacy of titanium implant through plasma surface treatment

Hyungyu Lee · Hyun Jeong Jeon · Ara Jung · Jinwoo Kim · Jun Young Kim · Seung Hun Lee
· Hosu Kim · Moon Seop Yeom · Wonho Choe · Bomi Gweon · Youbong Lim

Result & Discussion

The surface of SLA and SLA+Plasma was scanned with SEM to confirm whether plasma treatment causes any physical changes to the implant surface. As can be seen in the the 5,000 $\times$ and 10,000 $\times$ images in Fig. 4, there is no noticeable difference between the surface condition before and after plasma treatment. More importantly, no damage such as cracks or corrosion sites was identified on the implant surface after plasma treatment. The macro- and micro-roughness in SLA surface is important for osseointegration, and these results demonstrate that plasma treatment maintain the unique topography of the SLA imaplant surfaces without affecting the intrinsic surface of the implant (Fig. 4).

Fig. 4 The SEM images of the implant surface a, c SLA and b, d SLA+Plasma sample. (a and b are magnified by 5000 $\times$, and c and d by 10,000 $\times$)



The degree of hydrocarbon contamination was determined by X-ray photoelectron spectroscopy, with an energy peak at 285 eV representing the atomic percentage of carbon. It can be seen that the SLA and SLA+Plasma have carbon percentages of 26.2% and 11.0%, respectively, demonstrating that more than 58% of the hydrocarbons on the implant surface are eliminated by the plasma treatment as shown in Fig. 5a. In prvious study, it has been reported that protein adsorption to the implant surface increases with a decreasing number of carbon atoms on the surface, indicating a strong negative correlation with a high coefficient of determination ($R^2 = 0.930$) between the number of carbon atoms and the amount of adsorbed protein on the implant surface. Similarly, when carbon is gradually eliminated, osteoblast adhesion grows substantially, and the amount of hydrocarbon is also known to be strongly related to cell adhesion rates. Therefore, we use proteins and cells to perform in vitro experiments to identify the effects of plasma-treated surfaces on osseointegration efficiency. Fibronectin is used in the protein adsorption experiments. When a titanium implant is placed into a bone, protein adsorption occurs on the implant surface as the first physiological phenomenon when it comes into contact with physiological fluids around the site. Among the numerous extracellular matrix (ECM) proteins, fibronectin, in particular, plays an important role in promoting cell adhesion and proliferation by providing an integrin-binding site. We compared the amount of protein adsorbed to SLA and SLA+Plasma surfaces to investigate the effects of plasma treatment on fibronectin adsorption. As shown in Fig. 5b, the amount of proteins adsorbed to the surface of the SLA and SLA+Plasma is measured to be $2,029 \pm 236.4$ and $2,529 \pm 95.7$ ng, respectively. Plasma treatment appears to increase protein adsorption to the implant surface by 24.6%. The number of cells on each implant surface is then measured using a microplate reader at a wavelength of 450 nm. As shown in Fig. 5c, the number of cells attached to the implant surface is approximately 38.5% higher in the SLA+Plasma than in the SLA immediately after the 2-hour time point. This implies that plasma treatment significantly enhances the cell adhesion efficiency. Also, it can be seen that the number of cells in the SLA+Plasma group is approximately 40.2% higher than that in the SLA group after 5 days of incubation, confirming that cells proliferate better on plasma-treated surface (Fig. 5c). ALP activity is then evaluated after 7 days of culture to assess the level of differentiation. ALP is generally used as an initial marker of osteogenic differentiation, and high ALP activity indicates that cells are more capable of differentiation and functioning as osteoblasts. The ALP activity of the SLA and SLA+Plasma groups is 1.78 ± 0.42 and 3.23 ± 1.23 unit/ml, respectively, as shown in Fig. 5d, demonstrating that ALP activity in the SLA+Plasma group is approximately 81.5% higher than that in the SLA group.

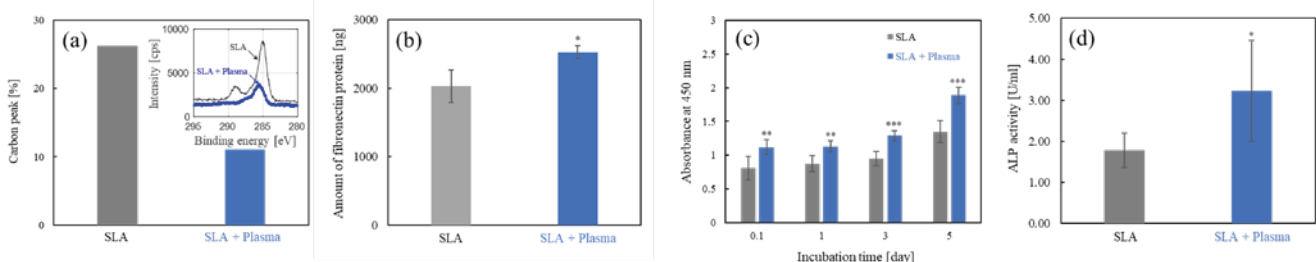


Fig. 5 Results of a XPS analysis, b protein adsorption, c cell proliferation, and d ALP activity for SLA and SLA+Plasma samples.

* $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$ (Unpaired student's t -test. Each SLA+Plasma data was compared to the corresponding SLA data.)



Enhanced Osteoblast Adhesion and Proliferation on Vacuum Plasma-Treated Implant Surface

Hyun Jeong Jeon, Ara Jung, Hee Jin Kim, Jeong San Seo, Jun Young Kim, Moon Seop Yum, Bomi Gweon, and Youbong Lim

Discussion

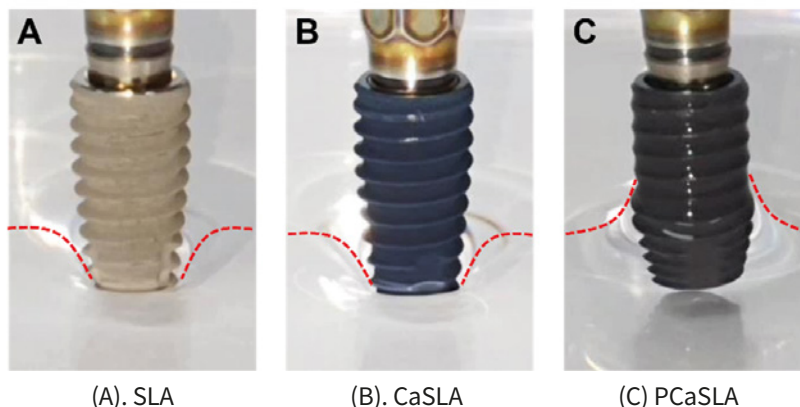
N₂ plasma treatment on TiO₂ was shown to reduce Ti⁴⁺ to Ti³⁺ as in UV treatment, generating oxygen vacancies and leaving TiO₂ positively charged. It has also been demonstrated that air-based O₂ plasma treatment forms a hydroxyl (OH) group on the TiO₂ surface, which is known to improve the hydrophilicity and binding affinity with proteins.

Based on these previous studies, the increase in hydrophilicity, improvement in protein adsorption, and cell adhesion observed in our study can be considered a result of the plasma-induced chemical process on the implant surface. In our in vitro investigation, the plasma-treated implant (PCaSLA) showed significantly higher levels of protein adsorption, osteoblast adhesion, and differentiation than the non-treated implant (CaSLA). In addition, when observing the morphology of cells attached to PCaSLA, cells were more evenly and widely attached than that on CaSLA. These results are believed to be relevant to the increased hydrophilicity of the implant by the plasma. Ujino et al. have reported that plasma-induced surface modification increased hydrophilicity, cell adhesion, and further upregulated osteogenesis-related genes such as Runx2, ALP, and BMP-2. In addition, they observed twice as much calcium deposition on the plasma-treated titanium surface compared to the control, indicating a high degree of clinical relevance.

As mentioned in the Section 1, hydrocarbon-based impurities are generally known as detrimental to protein adsorption and osteoblast adhesion. Aita et al. (2009) have shown a strong negative correlation between the level of carbon and the attractiveness of protein and cells. Accordingly, they suggested that carbon removal contributed to improving bone-implant integration. Therefore, our experimental results in which plasma treatment reduced the amount of carbon on the implant surface are very encouraging. Plasma contains various high-energy species, including electrons, charged species, reactive oxygen species, metastable atoms, UV photons, etc..

Given the fact that there is no extra gas supplied to our plasma device, the main discharge gas is air. In consequence, plasma will contain oxygen-related species such as O⁺, O₂⁺, O⁻, and O₃⁻. In a number of investigations related to plasma cleaning, researchers have demonstrated that carbon contaminants react with these oxygen-based species and become dissociated and reduced, releasing CO₂ and H₂O. Furthermore, continuous pumping to maintain a vacuum in the package removes these by-products immediately after they are released, eliminating the possibility of re-contamination.

More importantly, all of these plasma-bioactivation effects were achieved without causing any damage to the implant's existing calcium coating or microstructure. This is crucial in applying plasma treatment to the calcium-coated implant because if the plasma treatment damages the calcium coating, the osseointegration efficiency may be impaired rather than improved. According to many previous studies, calcium coating on the implant is known to promote osseointegration. Feng et al. (2004) have demonstrated that calcium coating on the implant surface increases the adsorption of protein and improves the adhesion and proliferation of cells. They reported that the calcium coating positively charged the implant surface with Ca²⁺ ions, which created a favorable environment for FN and Vitronectin (VN) adsorption, leading in increased osteoblasts attachment.



(A). SLA

(B). CaSLA

(C) PCaSLA



Plasma surface treatment technologies to enhance osseointegration of titanium implant: literature review

You bong Lim - plasmapp Co., Ltd., Moon Seop Yum - Seoul Top Dental Clinic

Abstract

Introduction

Titanium implants have become the most prevalent method for replacing missing teeth over the past 50 years. Titanium is biocompatible but biologically inactive material; therefore, there are several technologies that can improve its bioactivity, such as sandblasting and acid-etching, and calcium coating. However, concerns remain due to the bioactivity aging due to the long storage time and following hydrocarbon deposition. Concerns about surface aging motivated the development of various chair-side surface treatment solutions. The purpose of this review is to introduce the plasma surface activation method and assess its potential for future clinical application.

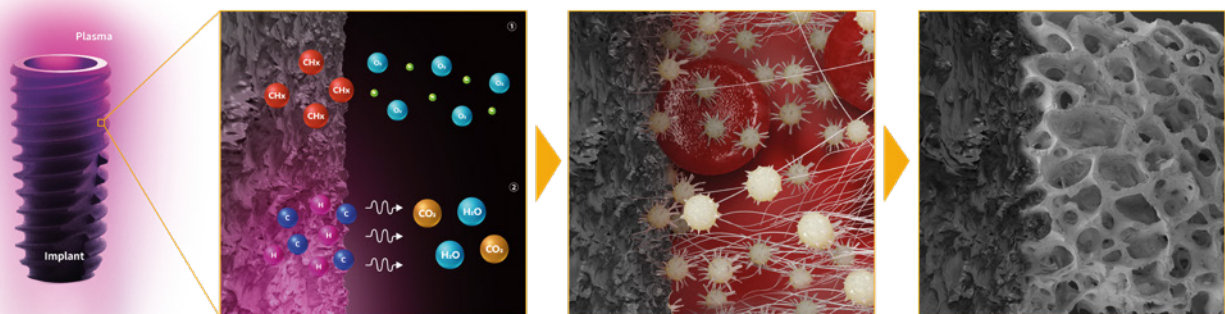
Materials and Methods

The PubMed search was performed using the terms 'plasma surface treatment,' 'osseointegration,' and 'dental implant' to retrieve 58 articles published in the last five years, from 2018 to November 8, 2022. Based on the correlation with plasma surface treatment on dental implants, we reselected 38 papers from this group.

Results and Conclusion

The current review demonstrated that plasma surface treatment on dental implants is remarkably effective at promoting osseointegration. Particularly, plasma surface activation has been demonstrated to improve extracellular protein adsorption, cell adhesion, and differentiation. Furthermore, these effects shown in vitro were also validated in vivo through increased bone-to-implant contact and peak torque in a number of pre-clinical studies. If further clinical trials corroborate this effect and efficacy, plasma surface activation technology is anticipated to be widely utilized as a chair-side solution.

Key words: Dental implant, Osseointegration, Plasma surface treatment



ACTILINK® IMPLANTOLOGY

Proven Performance with Freedom



Plasmapp Co., Ltd.

Sales | 13F, 476, Gangnam-daero, Gangnam-gu, Seoul, Republic of Korea [06120]

R&D 1 | 9, Giheungdanji-ro 24beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea [17086]

R&D 2 | 372, Dongbu-daero, Osan-si, Gyeonggi-do, Republic of Korea [18151]

Factory | 102, Cheombok-ro, Dong-gu, Daegu, Republic of Korea [41061]

www.plasmapp.com | sales@plasmapp.com

Specifications are subject to change without any notice.

Some products listed in this catalog are not available for sales in all markets due to pending regulatory clearance.

Please contact the local sales representative for current products availability.

Copyright© 2017 Plasmapp Co., Ltd. All rights reserved.

actib-en-2311 (Rev.1)