



TOOTH TRANSFORMER®

**The easiest and safest way to turn
teeth in autologous graft**

**TO TRANSFORM THE TOOTH
IN AUTOLOGOUS GRAFT EASILY AND SAFETY**

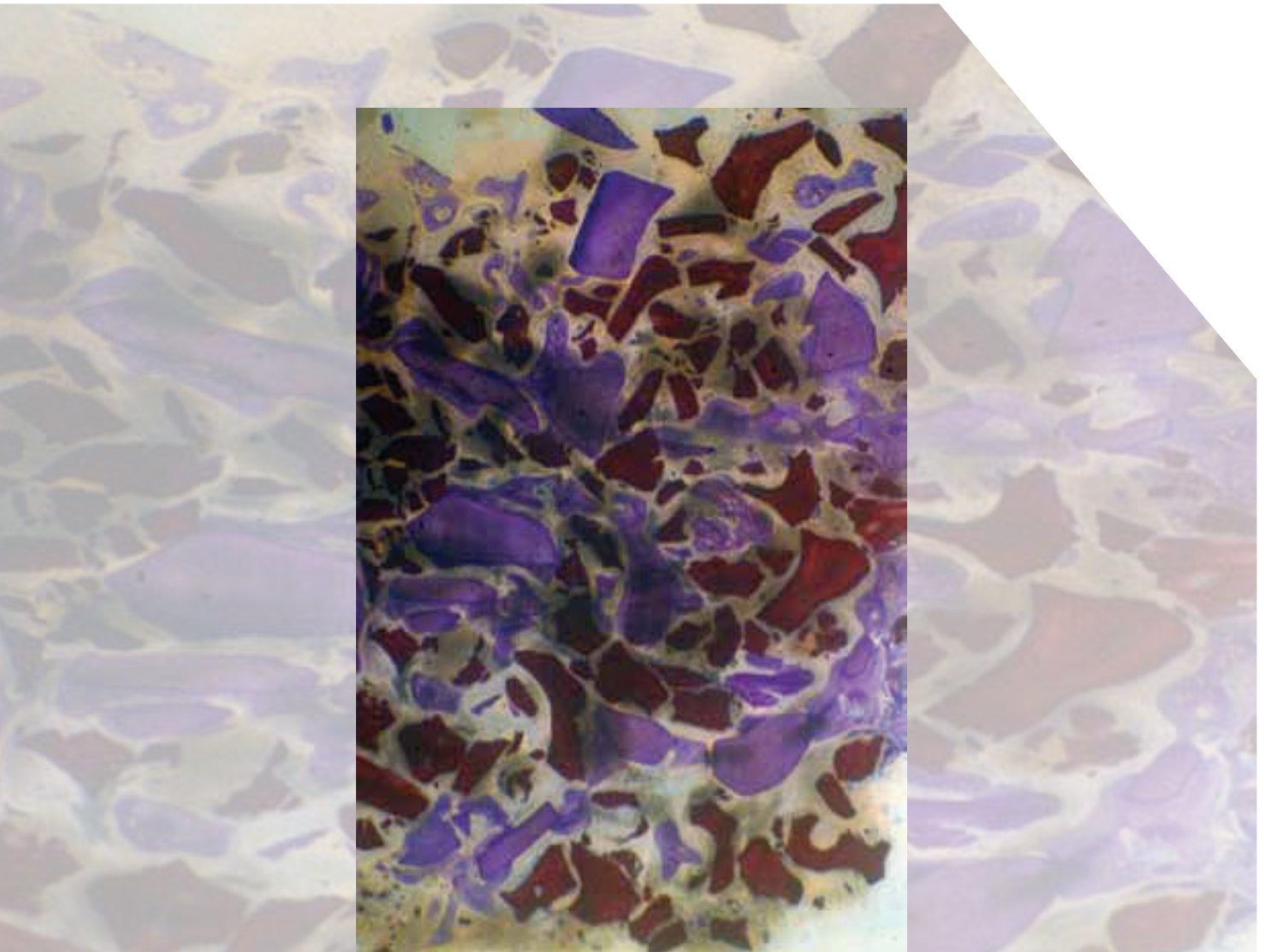




Tooth Transformer®



Teeth have memory



In purple: Dentinal granules surrounded by bone



In dark red: Demineralized bovine bone granules not surrounded by bone (at the same healing time)



Tooth Transformer® is an innovative system that turns teeth into autologous graft material for (predictable) bone regeneration. An extracted tooth can be automatically processed and transformed in excellent quality bone graft material in few minutes.

The tooth, like bone, is composed of type I collagen and Hydroxyapatite crystals(HA). Tooth hydroxyapatite has high crystallinity and it is not resorbable.

The The obtained particulate determines a mechanism of osteoinduction and stimulates adhesion, proliferation and cell differentiation during the bone regeneration process.

Tooth Transformer reduces hydroxyapatite crystallinity and through its exclusive procedure makes dentinal morphogenetic proteins and growth factors available for use.

This graft is completely bacteria-free, it is absolutely biocompatible and it is free from adverse immune reactions. The high wettability allows an easy handling thus making the surgical procedure easier.

CONTENT

	INORGANIC	ORGANIC	CRYSTALLINE
ENAMEL	96%	4%	HA (β-TCP) High density
DENTINE	65%	35%	HA (β-TCP) Low density
CEMENT	50-55%	45-50%	HA
ALVEOLAR BONE	65%	35%	HA (β-TCP) Low Ca/P ratio
DEMINERALIZED DENTIN	55%	45%	HA (β-TCP) Low Ca/P ratio

COMPOSITION

Dentin and bone tissue have an almost identical chemical composition.

Tooth Transformer[®]



Tooth Fairy[®]

the exclusive preserving system to take care of the patient's tooth that keeps its osteoinductive capacities unchanged over time.

The container has a particular lock system that allows the doctor to check the origin of the tooth. With this system you have the certainty of the Autologous tooth.

Inside the container the doctor will be able to indicate the patient's references, the date of extraction, the type of tooth, this information will be useful for future surgeries.



Tooth Grinder[®]

< the blades are made of surgical steel.

The Tooth fragments are placed into the Tooth Grinder[®]. The Tooth Grinder[®] is the only part of TT that requires maintenance: it must be sterilized at each preparation cycle. The container is made of ceramic resin and it is equipped with blades able to grind the tooth at very low speed (rpm).

TT single use kit[®]

The TT conversion kit provides specific solutions for disinfection and demineralization of the treated teeth.

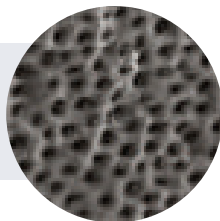
It is disposable and sterile in order to be ready for the surgical environment.

It is inserted into the TT Machine at the first phase of the transformation cycle.



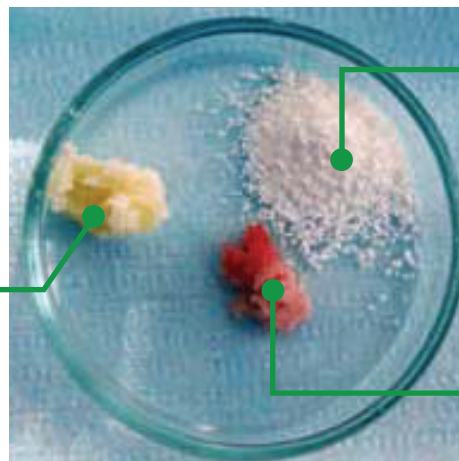
< Liquid cartridge/
Liquid collection cylinder/
Maker
(basket to collect the granular preparation)

Demineralized dentine,
SEM view



Autologous tooth processed by the TT.

The consistency of the autologous tooth prepared with TT is very plastic and easy to handle.



Demineralized
bovine bone

Autologous bone collected
with bone scraper



SCIENTIFIC BACKGROUND

The composition of dentin is similar to bone

■ Goldberg M1, Kulkarni AB, Young M, Boskey A. Dentin: structure, composition and mineralization. *Front Biosci (Elite Ed)*. 2011 Jan 1;3:711-35.

In this study, we thoroughly examined:

A- The specificities of the different types of dentin that form the dentin as a whole.

B- the composition and functions of the molecules of the extra cellular matrix.

The similarity of dentin with bone tissue has also been demonstrated.

Tooth as a grafting material

■ Masaru Murata, Toshiyuki Akazawa, Masaharu Mitsugi, In-Woong Um, Kyung-Wook Kim and Young-Kyun Kim. Human Dentin as Novel Biomaterial for Bone Regeneration. www.Intechopen.com

- Given the osteoinductive properties of dentin, the use of human teeth as a new grafting material for bone regeneration has been studied.
- Dentin can be considered as a grafting material similar to bone and as an osteomorphogenetic protein carrier (BMP-2)
- The dentin demineralization treatment increases the availability of BMP-2, therefore the osteoinductive power of the material.

■ Bono N, Tarsini P, Candiani G. / Demineralized dentin and enamel matrices as suitable substrates for bone regeneration. *J Appl Biomater Funct Mater*. 2017 Jul 27;15(3):e236-e243. doi:10.5301/jabfm.5000373.

This study evaluated the effects of the processing cycle and the demineralization of enamel and dentin with the Tooth Transformer.

- Sterility of grafting material: no traces of bacterial contamination were found.
- Demineralization of enamel and dentin: the process, especially on dentin, produces a significantly higher amount of BMP-2 available, without removing too much collagen.
- Cell growth: in vitro dentin has proven to be a valid support for cell proliferation and adhesion. The enamel has also showed excellent scaffolding characteristics.



Growth factors in teeth and bones remain intact thousands of years

■ Schmidt-Schultz TH1, Schultz M. / Intact growth factors are conserved in the extracellular matrix of ancient human bone and teeth: a storehouse for the study of human evolution in health and disease. *Biol Chem.* 2005 Aug;386(8):767-76.

- This fascinating study shows that compact bone and dentin are able to protect proteins present in the extracellular matrix over time (thousands of years) due to their high percentage of hydroxyapatite.
- For the first time, growth factors (IGF-II -2 BMP-2 and TGF-beta) were extracted, from compact human bones and dentin that dated back to the Late Neolithic and the beginning of the Middle Ages.

The BMPs present in the dentin are osteoinductive

■ Bessho K1, Tanaka N, Matsumoto J, Tagawa T, Murata M. Human dentin-matrix-derived bone morphogenetic protein. *J Dent Res.* 1991 Mar;70(3):171-5.

The bone morphogenetic protein (BMP) present in the extracellular matrix of human dentin was extracted, purified and implanted in rats.

Subsequent analysis have shown that the BMP obtained from the dentinal matrix induced a new bone formation in the animals after three weeks.

A partial sequence of amino acids from the final purified BMP was obtained. BMP derived from dentin matrix is similar to BMP derived from bone matrix, both types of BMP have been shown to have the same action in vivo.

■ Blum B1, Moseley J, Miller L, Richelsoph K, Haggard W. / Measurement of bone morphogenetic proteins and other growth factors in demineralized bone matrix. *Orthopedics.* 2004 Jan;27(1 Suppl):s161-5.

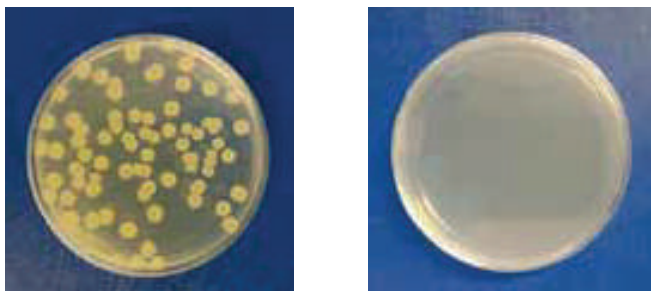
- The success of graft materials containing demineralized bone matrix has been closely related to the osteoinductivity of the matrix itself.
- Osteoinductivity of the demineralized bone matrix has been attributed to bone morphogenetic proteins (BMP) but other growth factors, including insulin-like growth factor 1 (IGF-1) and transforming growth factor beta1 (TGF-beta1), have been detected.
- Confirmation and measurement of osteoinductivity can play a crucial role in predicting the success of the bone graft.

EFFECTS OF TOOTH TREATMENT WITH TT

Absence of bacteria

The TT sterilization protocol has been investigated. Fragments of non treated teeth and of teeth treated with TT were inserted on culture to evaluate the bacterial proliferation of each one.

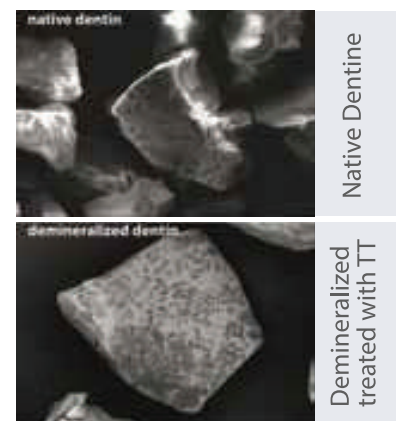
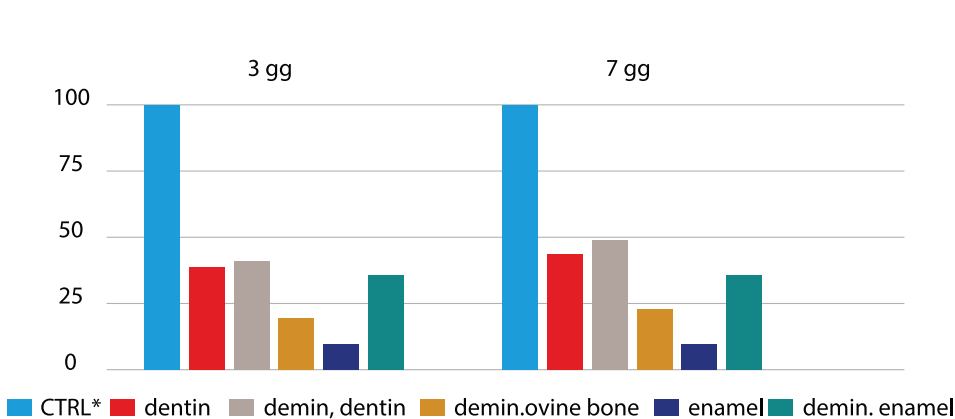
On the left, bacterial contamination is present on the dentine fragments before treatment. On the right, the particulate obtained from TT is absolutely free of bacteria.



< Native Dentine / Treated Dentine

Increased cell proliferation on the surface of the graft

Dentin proves to be extremely effective for bone reparation and regeneration, since the demineralization treatment maintains its original features and properties. Even the demineralized enamel, subjected to the same physical-chemical process, proves to have a better osteoconductive attitude compared to the native one.



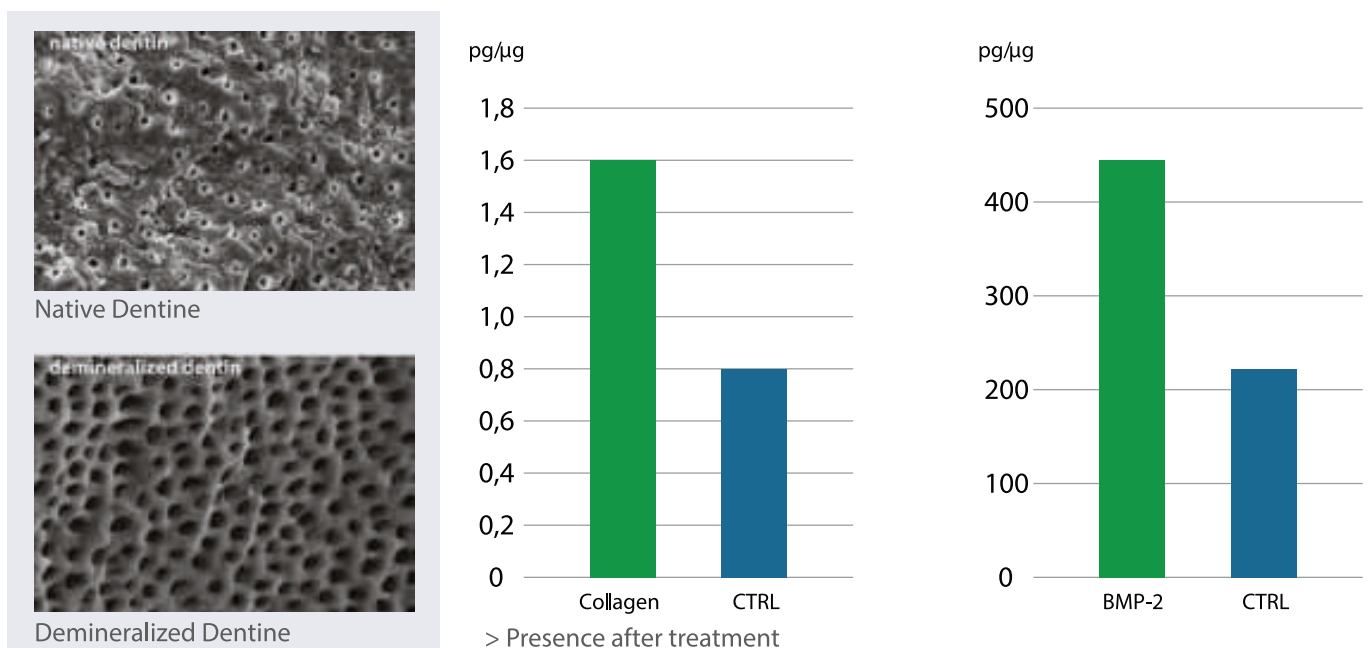
Proliferation of SAOS-2 cells after 3 and 7 days on different materials (native dentin, demineralized dentin, DBBM, enamel and demineralized enamel) CTRL * specific medium for the culture of this cell strain. Maximum obtainable result.

After the treatment the number of cells on the surface of the dentin granule is increased after the treatment.

IN VITRO RESEARCH

Presence of morphogenetic proteins and collagen

The hard tissues forming a tooth are mainly composed of an inorganic mineral phase (70-96%). The partial demineralization process of the Tooth Transformer® produces a significantly higher quantity of available growth factors compared to those of the mineralized tissues. Furthermore, the treatment preserves the intimate structure of the dentin (that one of the enamel is more resistant) and does not affect the effectiveness of the growth factors obtained. On the lower left, a SEM picture of both the native and the demineralized dentin. In the center and on the right, the availability of collagen proteins and growth factors after the treatment of partial demineralization compared to the control group. Amorphous dentin is present on the dentine fragments before treatment. On the right, the particulate obtained from TT is absolutely free of bacteria.



Analysis carried out at the Department of Chemical Engineering of Materials "G. Natta", Polytechnic of Milan I.N.S.T.M.

Bono N, Tarsini P, Candiani G / Demineralized dentin and enamel matrix as suitable substrates for bone regeneration J Appl Biomater Funct Mater 2017; 15(3):e236-e243 DOI:10.5301/jabfm.5000373.

Bono N, Tarsini P, Candiani G / BMP-2 and type I collagen preservation in human deciduous teeth after demineralization. J Appl Biomater Funct Mater. 2018 Jul 26:2280800018784230. doi: 10.1177/2280800018784230. [Epub ahead of print]



IN VIVO RESEARCH TT

■ Minetti E, Berardini M, Trisi P.

A new tooth processing apparatus allowing to obtain tooth grafts for bone augmentation: the Tooth Transformer. The Open Dentistry Journal, 2018, 12

- **Purpose:** Testing an innovative medical device that could obtain dental grafting materials starting from the whole patient's tooth.
- **Materials:** 15 consecutive cases of dental grafting procedures were performed with an average follow-up period of 18 months.
- **Results:** in all cases, after 6 months of healing, the defects were almost completely filled with newly formed hard tissue. The new tissue was examined after 6 months, both from a radiological point of view with CBCT scans and from clinical observation. It showed a similar compactness to medium density bone. No signs of inflammation were observed. No infectious complications were recorded during post-operative healing. In the regenerated bone structure no particles or grains of graft were visible and they appeared homogeneous and uniform.

■ Minetti Elio, Palermo Andrea, Taschieri Silvio Luigi, Trisi Paolo

Tooth Transformer: a new method to prepare autologous tooth grafts. Histologic and histomorphometric analyses of 11 consecutive clinical cases.

Submitted

- **Purpose:** to evaluate from a histological and histomorphometric point of view the tissue obtained after the healing of the graft obtained from the fragmented and partially demineralized patient's tooth.
- **Materials:** in 11 consecutive cases, dental grafting procedures were performed on patients who needed GBR procedures. After a healing period of 4 to 6 months all patients underwent a new intervention for implant placement. The osteotomies were performed with a 3 mm diameter core drill to obtain a bone sample for each site.
- **Results:** the histological analysis of this case series shows the regeneration of bone tissue around dentin granules and the absence of inflammatory reactions. The graft in all the analysed cases was subjected to a physiological remodeling demonstrating an excellent integration with the host tissue.





Clinical trials and multicenter studies submitted

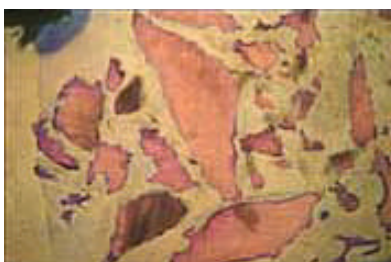
- Tooth Transformer: a new method to prepare sinus lift autologous tooth grafts. Histologic and histomorphometric analyses of 4 consecutive clinical cases.
(Elio Minetti, Andrea Palermo)
- The tooth could be a graft?
(Elio Minetti, Silvio Taschieri)
- The average teeth weight and volume?
(Elio Minetti, Silvio Taschieri)
- Demineralized deciduous tooth as a source of bone graft material: a case report.
(Elio Minetti)
- A new method to prepare autologous tooth graft for socket preservation techniques: a multicenter clinical study
(Minetti Elio, Palermo Andrea, Schmitz Johannes, Ho Henry, Hann Simon, Giacometti Edoardo, Gambardella Ugo, Contessi Marcello, Celko Martin, Paolo Trisi, Silvio Luigi Taschieri)
- A New method of preparing autologous tooth graft for sinus lift techniques : a multicenter clinical study.
(Minetti Elio, Palermo Andrea, Contessi Marcello, Gambardella Ugo, Schmitz Johannes, Giacometti Edoardo, Celko Martin, Paolo Trisi)
- Comparison between the bone regeneration using tooth graft with or without Tooth Transformer in sheep.
(Minetti Elio, Palermo Andrea, Contessi Marcello, Gambardella Ugo, Schmitz Johannes, Giacometti Edoardo, Celko Martin, Paolo Trisi)
- Is it possible to use teeth with root canal therapy as graft material? Multicenter study
(Minetti Elio, Palermo Andrea, Schmitz Johannes, Ho Henry, Hann Simon, Giacometti Edoardo, Gambardella Ugo, Contessi Marcello, Celko Martin, Paolo Trisi)

Studies in animals

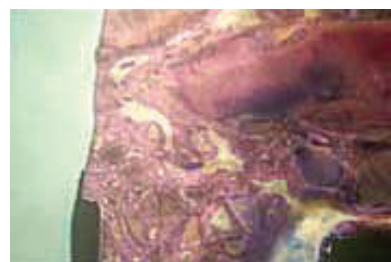
■ Palermo A, Minetti E

Tooth Transformer: Histologic analysis of tooth grafting on bone regeneration in artificial defects. An experimental study in sheep iliac crest and mandible. Submitted for publication

The aim of the present paper is to analyze the histologic outcomes in Four hollow titanium cylinders 4.0mm internal diameter and 8mm length, termed "bone growing chambers" (BGC). BGC were inserted in two sheep mandibles: in the right side the BGC was filled by the tooth graft treated using a Tooth Transformer device while in the left side BGC was filled with tooth graft without any treatment (control group). After 2 months of healing the BGC were retrieved and histological analysis were performed.



< After the healing period, around the untreated granules there is no newly formed bone



< After the healing period, around the treated granules there is a large quantity of newly formed bone.

CLINICAL INDICATIONS

Alveolar preservation

**Woman, 48 years old, el. 36 (# 19),
33 months follow up**

Due to the root fracture with suppuration, the buccal wall of the alveolus has been lost. After extraction, a demineralized dentin graft was placed.

After four months the bone regeneration is already appreciable on the buccal wall of the alveolus.



Time 0



Time 4 months

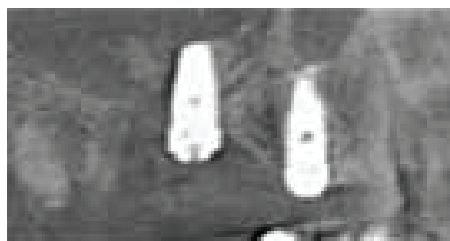


Final rehabilitation

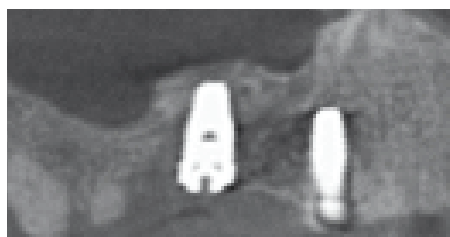
Sinus lift graft

**Man, 48 years old, el. 36 (# 19),
33 months follow up**

Post-op XR. shows the reduced amount of graft positioned. In the following 6-months check, we can appreciate that the whole material (demineralized dentin) remained absolutely stable. Histology confirms the transformation of the graft into newly formed bone tissue and the presence of reabsorbed granules.



Time 0



Time 6 months

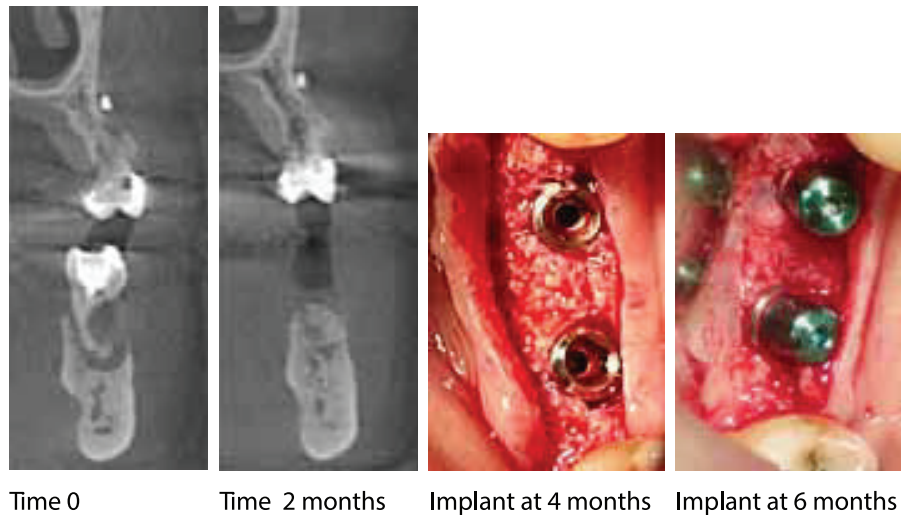


Histology at 6 months

Horizontal regeneration with vertical component

**Woman, 42 years old, el 35-36 (#20-19)
defect 19x9x10mm,
20 months follow up**

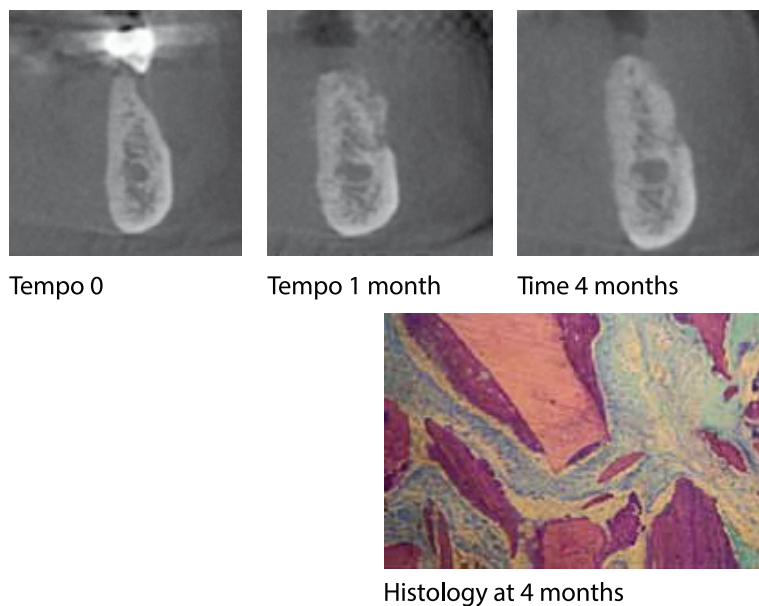
The heavy chronic perio-pathology has created a large defect that has required an horizontal and vertical regeneration to recover the lost bone volume and to allow a correct implant positioning. By two clinical images, at 2 and at 6 months, we can appreciate the maturation of the bone tissue.



Horizontal regeneration

**Woman, 62 years old, El 45-46 (#29-30)
defect 10x4x8 mm.
10 months follow up**

Horizontal mandibular regeneration. Initial CBCT (time 0), after 1 month and after 4 months. The thickening of the buccal cortical area shall be noted. Histology at 4 months: it is very noticeable the bone regeneration around dentin granules.





FEATURES



The Tooth Transformer® is available in 4 different colors



The Tooth Transformer® device was specifically studied and developed to transform into granules the patient's tooth, and to treat it in order to produce an autogenous bone grafting material available for use into the patient himself.

The Tooth Transformer® system consists of the following elements:

- **DEVICE:** it is equipped with switches, screen, lid.
- **MAKER:** it is a disposable accessory placed inside the cylinder to collect the particulate .
- **CYLINDER:** it is a single-use accessory in which the liquids are collected after use.
- **CARTRIDGE:** it is a single-use accessory that contains liquids and reagents.
- **TOOTH GRINDER®:** this component includes the blades that grind the tooth.
- **DRAWER:** collects possible processing residues, thus facilitating the cleaning of the device.
- **USER MANUAL:** describes how to use the device.





Testimonials

Dr. Paolo Trisi



I have analyzed many biopsies of tooth dentin treated with TT. The histological analysis showed the substitution with new bone (40% of new bone formation) with the inclusion of the residual granules (20% of total graft volume). In all cases the results are positive.

The procedure is very simple and the graft material management is very good such as the clinical healing. The amount material that is obtained is surprising

Dr. Carlo Poggio



Dr. Johannes Schmitz



The bio-active graft material produced with TT, deriving directly from the patient's genetic patrimony, induces amazing results even using simple surgical procedures with reduced morbidity for my patients.

There is something that is natural and free from our own body. Autogenous tooth material is the ideal choice that we use in our practice today. What used to be trash - we extract, we throw - today to me is gold!

Dr. Henry Ho



Dr. Marcello Contessi



From now on I cannot do without processing an extracted tooth in the TT Device and use it in my socket preservation techniques. It is a cheap, autologous, extremely effective grafting material. The quality of the obtained recipient site for my implants was surprisingly high, even in previous huge bone defect and in traditionally poor bone areas. The histology confirmed it all, very comfortably.

- **Prof. Elio Minetti** Milano- Italy / Graduate in Dentistry University of Milan – Italy / Postgraduate Certificate in Implantology and Aesthetic dentistry NYU – USA / Clinical Coordinator New York University C.D.E. – USA / Scientific Responsible Tooth Transformer / Professor University of Bari Master Advanced Oral Surgery- Italy .
- **Dott. Mauro Libertucci** Roma - Italy / Graduate in Dentistry University of Rome - Italy. Founding Member of SIKMO (International Society of Holistic Medical Kinesiology), author of the DOOR surgical technique (Double Overturning of Ridge) and Founder and Administrator of the Facebook group "HeartGuideDentistry". He has worked as a freelancer since 1991 in Tivoli - Italy.
- **Prof. Giampiero Massei** Torino – Italy / Graduate in Medicine University of Turin – Italy / Postgraduate in dentistry University of Turin – Italy / Master in Maxillo Facial Surgery University of Zurich – Swiss / Professor University of Genova, Torino and Chieti – Italy.
- **Prof. Henry Kim Lung Ho** Singapore- Singapore / BDS from the National University of Singapore – Singapore / Masters in dental surgery (Prosthodontics) from the National University of Singapore – Singapore / Membership in Restorative Dentistry of the Royal College of Surgeons (Edinburgh)– UK / Director of the Institute of Advanced Dental Education and Training (IADET) / Professor University of Frankfurt, University of Titu Maiorescu, University of Naples Federico II.
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- **Dott. Jesus Santillana** Dentistry Graduation at the European University in Madrid / GDP in Manchester and Brighton (UK) for 2 years with Oasis Dental Care/ Implantology Specialitation at the International Institute of Implantology in Barcelona, Madrid and Paris/ Oral Surgery Speciality at the Delafontaine Hospital in Paris/ Lessons to students on cadaver of the MIRIP courses in anatomy, implantology and surgery at the Rene Descartes V in Paris/ Specialitation on GBR and Reconstructive Bone . Khoury Technique / Mucogingival Course with Dr Fonbellida in San Sebastian/ course about Apneas with Dr Edardo Anitua . BTI / Socket Shield course and socket preservation . Management of VERSAH (osseodensification Concep) / GBR course (5 days) in Budapest with Dr Istvan Urban/ IADI course about bone regeneration, vertical and horizontal in San Francisco (Dr Samuel LEE) / Private practise oral Surgery.
- **Prof. Tomás Beca** Madrid - Spain. Graduate in Universidad Europea de Madrid/ Postgraduate Oral. Implantology and Implant Prostheses, Universidad San Pablo CEU/ Professor Knotgroup Dental Institute - Universidad Católica de Murcia/ Professor Advance Implantology McGann Postgraduate School of Dentistry/ Professor of the Master of Oral Surgery and Implantology, Francisco de Vitoria University/ Lecturer in Granada University, Santiago de Compostela University/ International Speaker, Frankfurt, Slovenia, New York/ Membership of ICOI/ Private practice in oral surgery since 2003

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