R2GATE®

by MEGA'GEN

Turning imagination
into reality
since 2012

MEGA'GEN
For Lifetime Smiles


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SINCE 2012

What is R2GATE®

R2GATE is an innovative implant diagnostic software that analyses the oral condition and it shows the best option for implant treatment.

CBCT (Dicom)

CBCT is the most efficient method for implant diagnosis. Through CBCT, you can easily identify the shape of the bone and other skeletal structures. But it has an original distortion and not accurate enough for complete treatment planning by itself.

Digital EYE (Bone)

After intuitively checking the shape and density of bone via Digital Eye, you can obtain strong initial stability by customizing the drilling sequence.
The software also provides a guideline for whether immediate loading is possible or not.

STL (Soft tissue & teeth)

R2GATE merges the STL (3D scanning of model or impression) with the CBCT file to overcome the CBCT's limitations such as Metal Scattering and distortion.
STL intuitively shows the gingiva and neighboring teeth.

Top-Down Treatment planning

The purpose of implant treatment is to recover lost and functionless teeth.
With R2GATE, you can select the ideal position of an implant by checking the crown design, and occlusion with neighboring and antagonist teeth.

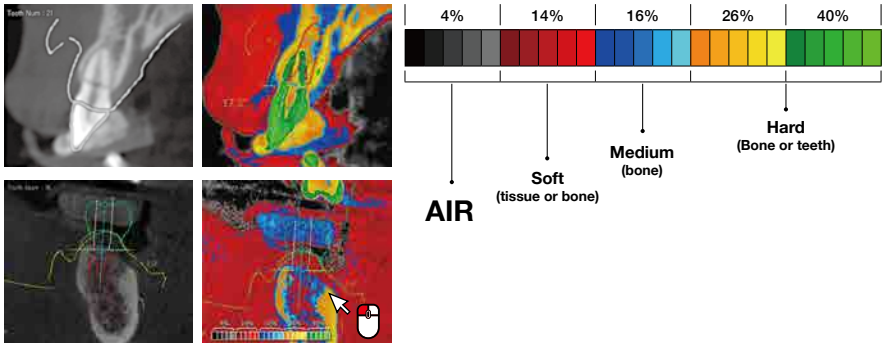
The most innovative and intuitive diagnosis software for Dental implant planning in the world.

I. Digital EYE™

Does your CBCT show you right information?

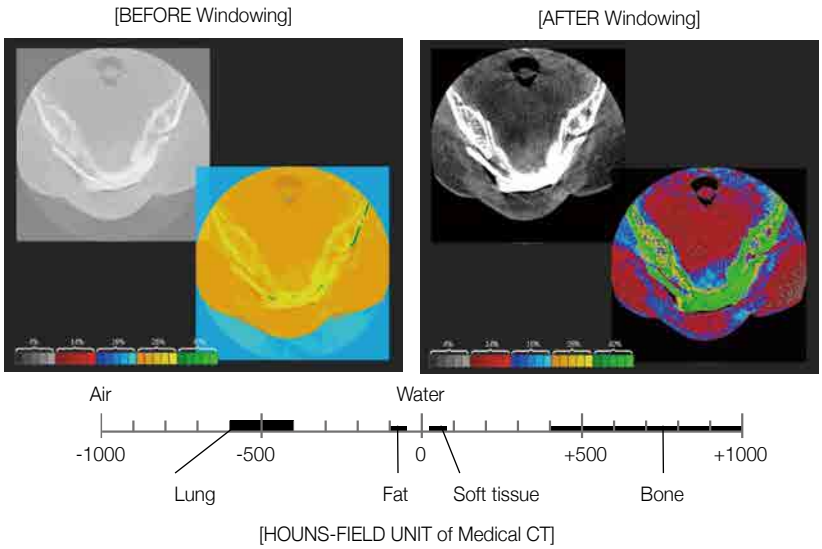
Black and White? It's only 5%

Regular black and white CBCT analyzes the data in 256-level of shades. We can only detect 16 levels with naked eyes. R2GATE's Digital EYE regenerates 256 shades into color to deliver much more detailed, intuitive bone condition.
It standardizes the brightness level that various CT equipment has and provides objective HOUNS FIELD UNIT.
It significantly differs from the color that other CT data provides. Based on this information, you can decide implant position and size and its drilling sequence for the initial stability of the implant.



Re-arrange of DICOM files for standardization.

Windowing function standardizes the brightness level that different CT equipment has and provides objective HOUNSFIELD UNIT.
It significantly differs from the color that other CT data provides.
Based on this information, you can decide implant position and size and the drilling sequence for the initial stability of the implant.



II. ONE-DAY IMPLANT™

Get your implant and prosthetics in one day!

Digital EYE™

Provides the predictable indications for Immediate loading.
According to the bone density and R2GATE treatment planning, patients can have customized abutments before the surgery, and it can be placed right after the implant surgery.

Place a Fixture as it is planned

Completely connect the Handpiece carrier into a fixture, and drill it down as it is planned using your R2GATE Guide

a. Depth of a fixture align the upper line of Handpiece Carrier with Guide Window as [Image 1]
b. Matching internal hex of a fixture fill the window with the green part of a carrier body as [Image 2]

[Image 1] [Image 2]

Prosthetics can be manufactured as single, bridge, or screw-retained type according to your preferences.

Cementation type

- Customized Abutment
- PMMA Temporary

Screw retained type

- Ti-Base
- PMMA CAD/CAM Provisional restoration.

Over-Denture type

- Stock abutment
- Customized abutment
- 3D Printed Denture

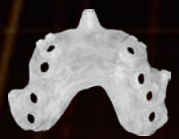
R2GATE® is already tried and trusted world wide.

Japan, China, Taiwan, Thailand, USA, UAE, Romania, Italy, Netherland, Australia, Germany, UK, Russia, Ukraina, Turkey...
Doctors are using R2GATE through out 30 countries.

R2 GATE
2013 ~ 2018

33,802 cases
Delivered to world wide

293,704 Implants



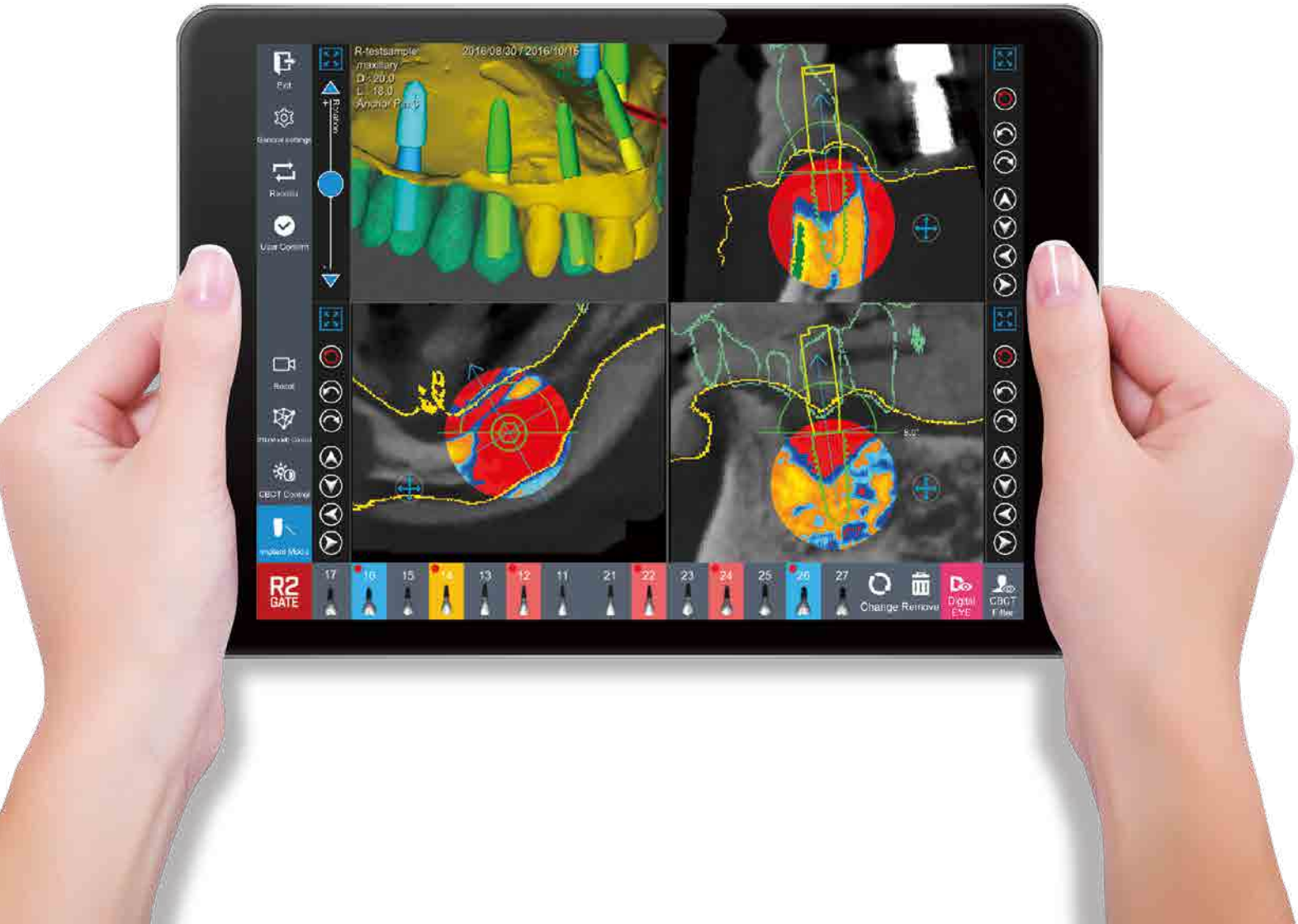
69,488 Prosthesis

R2GATE Lite™

Meet the most innovative

implant diagnostic software program in

the most innovative way!

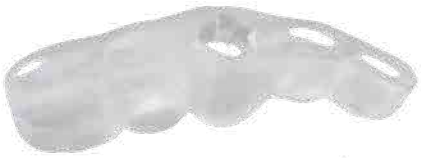


R2GATE GUIDE™

I. Advantage of R2GATE GUIDE

Experience the most innovative implant guide surgery!
Virtual planning becomes a reality.

R2GATE GUIDE doesn't need a metal sleeve or spoons.
It has the internal-structure for drill stopper and hex controller. R2GATE Guide surgery is more convenient and precise.



Precise R2GATE Guide using 3D Printer.

R2GATE guides are designed directly based on your diagnosis and are printed by 3D Printer.
The unique structures of R2 Guide(for drill stopper, implant position, and hex control)are printed as one-body for improved precision and convenience.

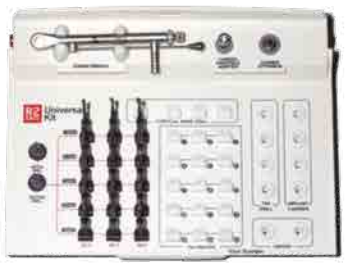
I. Advantage of R2GATE GUIDE

R2GATETM integrated with Major implant systems.

R2GATE Surgical Kits are available!

Full Kit and Universal Kit are available.
The full kit consists of a complete set of drills and system-specific implant carriers.
The Universal kit consists of drills from initial to 2.8 drills for any implant systems.
The implant carrier and disposable drills may be added as your option.

R2GATE Full Surgical KIT



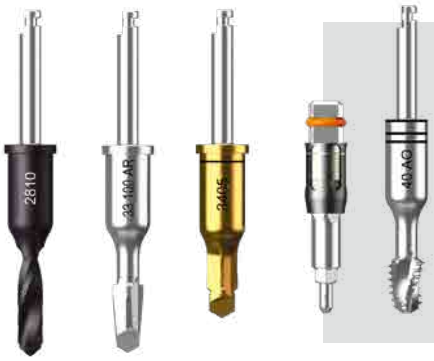
R2GATE Universal KIT

▸▸ Simple and Practical R2GATE UNIVERSAL KIT

Flexible kit for all implant systems

Simple and practical **Universal Kit**

R2GATE Universal Kit includes essential guide drills and tools that can be used for various implant systems. Final drills and other necessary tools can be added for your preferred implant system.



Add optional Tools for your preferred implant system

You can add optional tools like implant carrier, tap drill, cortical bone drill and more for your preference. Refer to MegaGen Implant Catalogue for more information.

We provide a new **Disposable final drill** for each surgery.

Along with with R2GATE Guide, we provide a disposable final drill for ideal initial stability based on the patient's bone density. Now, safer surgery can be done with our disposable final drill.

* permanent drill are available under your order.

Must have Accessory kit

R2GATE Narrow Guide kit for Mini System

Are you planning to use for a Mini implant? Are you worried about the surgery because of narrow surgical space? Narrow Guide Kit with ø3.5mm drill core is designed to overcome narrow surgical spaces such as anterior mandibular, narrow distance between adjacent teeth or adjacent implants.

R2GATE Anchor kit

R2GATE Anchor kit For the fixation of fully edentulous guid

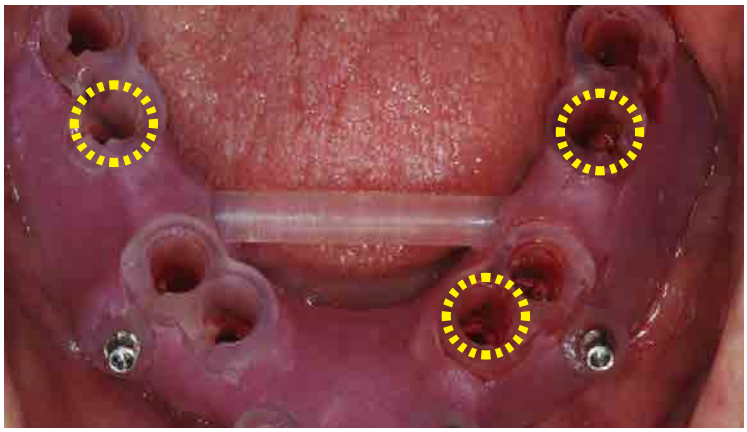
R2GATE Anchor Kit is used to fix fully edentulous R2GATE Guide in the mouth.

Anchor Pin:

Put R2GATE Guide and Putty Bite together and put it into patient's mouth. Let the patient bite firmly. Then, insert an anchor pin into the pin holes on the guide and fix them using a driver. If bone density is dense, Slightly drilling to penetrate cortical bone area with 2.0 x 13.0mm drill will be helpful for better fixation.

Anchor Screw:

For fully edentulous guide, placing fixtures and connecting anchor screw in a triangular form is highly recommended for better fixation as the image below.



When regular fixture and wide fixture are needed to place in edentulous case, there will be 2 set of R2GATE guides for regular fixture and wide fixture placement. Anchor screw will provide same position of fixation for both of R2GATE Guides.

II. R2GATE Guided Surgery

1. Preparations for R2GATE Guide™ Surgery

❶ Package check

Check what are contained in the delivery package received from R2GATE Design Center.

Prosthetics type
ZA : Zirconia customized abutment
PR : Provisional restorations

Patient's name

R2GATE Guide™ type
R : Regular core R2GATE Guide™
W : Wide core R2GATE Guide™

Patient's name

❷ Received two R2GATE Guide™?

Do you plan to place a wide diameter fixture ? One is for regular diameter of drills and another is for wide diameter of drills & fixture insertion.

All diameter of general drill hole(core) and guide part of drills are 5.0mm. So from 3.5 to 4.5 diameter fixture can be placed through general drill hole. But In order to insert wide diaeter fixture (over the 5.0mm), drill hole(core) should be made for wide diameter drilling and fixture insertion.

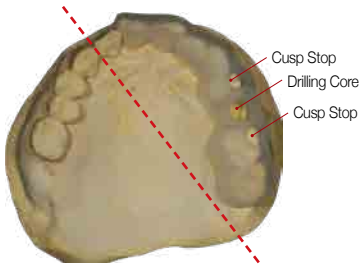
Drilling sequence:
Up to 4.3mm diameter of drilling, use the regular hole R2GATE Guide™ (marked "R"). Then that change to wide hole R2GATE Guide™ and continue to drill with bigger diameter drills.

❸ Sterilization for R2GATE Guide™ and prostheses

Put the R2GATE Guide™ and all prosthetics into a bowl (jar) with an antiseptics (ex. Chlorhexidine Gluconate) for 30 minutes before surgery.

▸▸ Types and retention of R2GATE Guide™

1. Tooth - supported type

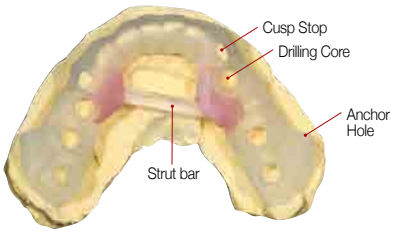


[Minimum size of model] Even it's tooth support type R2GATE Guide™, 3/4 arch model is required for design and accurate retention.

1~4 implants The residual teeth are still remained around the implantation site. The Main retention of R2GATE Guide™ comes from the remaining teeth. So, with the larger number of remaining teeth, retention will be higher and more stable. The damage and porosity of the remaining teeth on the model are not acceptable for the design of R2GATE Guide™ and its adaptation.

∗ Cusp Stop : To check the accuracy of R2GATE Guide™, Designer makes a few number of "Cusp stopper" on the cusp of the mesio-distal neighbor teeth. When R2GATE Guide™ is seated, check its fitness of contact between cusp and hole. There should not be a gap.

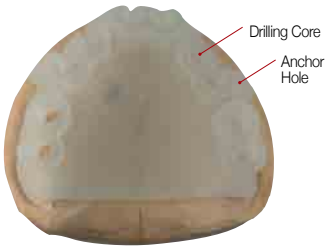
2. Dual - supported type



Free-end case Most of the free-end case, R2GATE Guide™ gets the retention from a remaining tooth and residual ridge. All anatomical forms of teeth, alveolar ridge, vestibule should be represented clearly on the model.

∗ Anchor Hole : The anchor hole can be designed for additional retention. The location will be decided during diagnosis and confirmed by user. Ø2.0 drilling might be required to insert anchor pin into the hard bone. (Maxillary anterior, Mandibulary regions).

3. Fully tissue - supported type



Fully edentulous case In the fully edentulous case, R2GATE Guide™ gets the support from the residual ridge and gets the retention from anchor pins. All anatomical structure (palatal, vestibulare) should be represented clearly on the model.

∗ Putty bite : Right initial positioning of R2GATE Guide™, putty bite will be provided. Combine putty bite and R2GATE Guide™ first than put it in the patient mouth together. Let the patient bite it strong and insert the anchor pin into each hole.

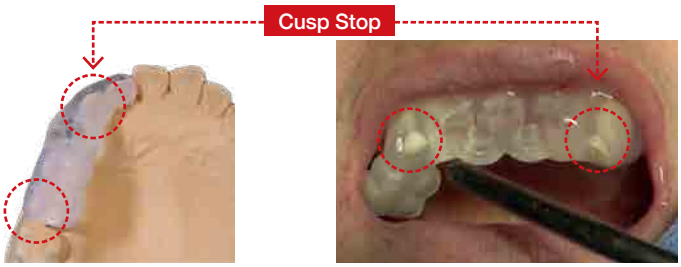
The distortion of the model is an important factor of the error on diagnosis and R2GATE Guide™. Please understand checking point of R2GATE Guide™ fabrication, and try to make accurate impression and model.

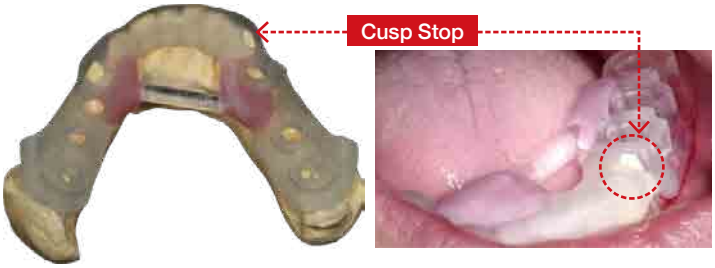
2. Adaptation of R2GATE Guide™ before surgery

This procedure is essential to check the accuracy of R2GATE Guide™.

❶ Tooth & tissue supported type

Check the "Cusp stop" of R2GATE Guide™ To check the accuracy of R2GATE Guide™, our designer makes a few number of "Cusp stoppers" on the cups of the neighboring teeth. When R2GATE Guide™ is seated, check its fitness between cusp and R2GATE Guide™ hole. There should not be any gaps.





❷ Fully tissue supported type

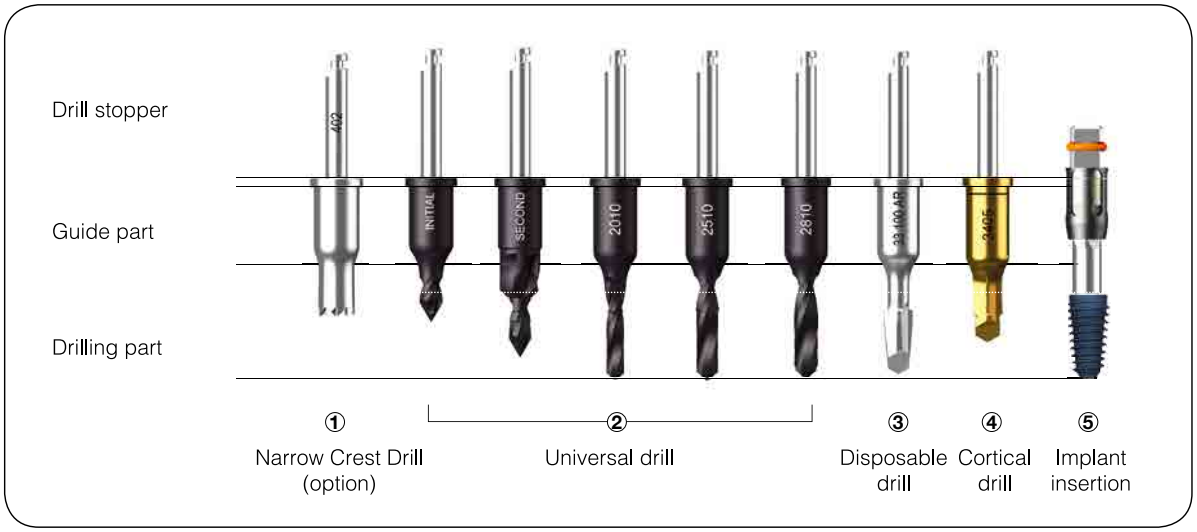
Putty bite and Anchor pin For an edentulous case, R2GATE Guide™ is seated using the putty bite and fixed with anchor pins specially designed for R2GATE Guide™ positioning.

1. The connected R2GATE Guide™ and the seating jig are delivered into the mouth together and seated.
2. Patient should bite with maximum occlusal force on the R2GATE Guide™ and seating jig.
3. Tighten the anchor pin using a hand driver.
4. 2.0mm drilling will be required in advance if the drilling point have a thick cortical bone.

3. Basic principles of drilling with R2GATE Guide™

No spoons, No sleeves
Our guided drill design does not need spoons or sleeves

All of our drilling components from initial drill to implant carrier are designed as guide and drilling part.
You do not need any additional sleeves or spoons, to shorter the surgery time.

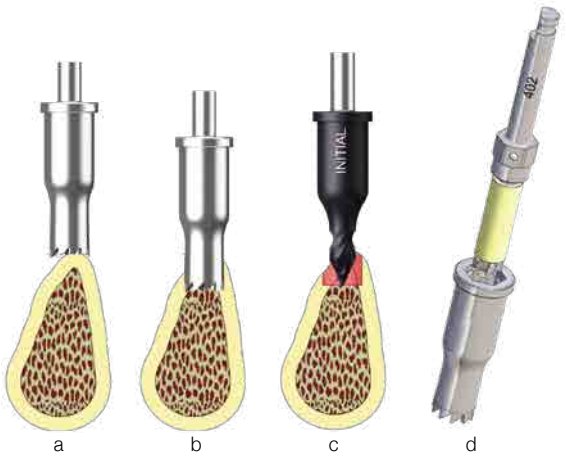


Narrow Crest Drill
for narrow or steep alveolar ridge.

If a regular drill is used on narrow or steep alveolar ridge cases, a drill may slip and the drilling path will be made in the wrong direction. In this case, use a narrow crest drill first and flatten the drilling area to prevent slipping.

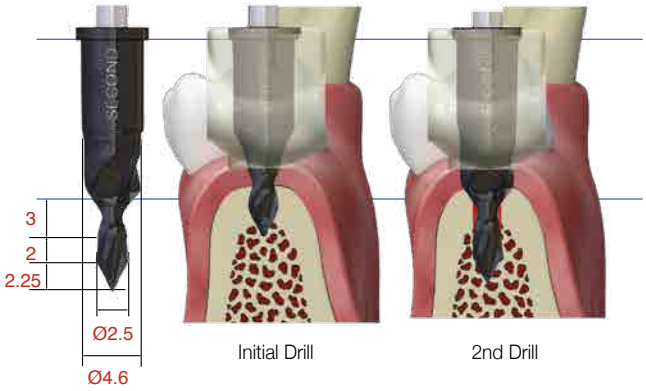
How to use the Narrow Crest Drill.

a. Counter-clockwise: Engage the blade onto the ridge by rotating a drill with less than 100 RPM
b. Clockwise: Drill with 400~600 RPM
c. Start a drilling sequence with initial drill
d. You can collect bone by separating the drill body after drilling



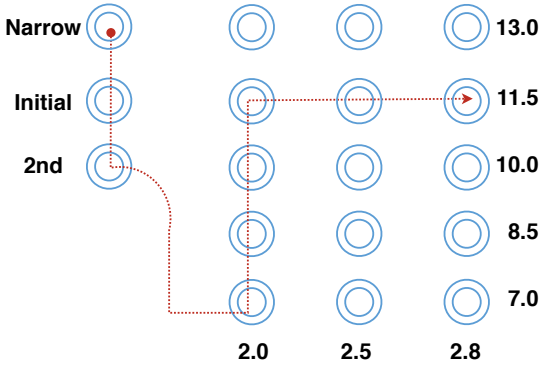
1st & 2nd Drilling

The 2nd drill also works as a profiler drill which removes excess bones above the fixture platform for a better has connection of prosthetics. If bone density is dense or high resistance during drilling, stop 2nd drilling protocol and repeat 2nd drilling protocol right before fixture placement.



Crucial Step: Basic drilling

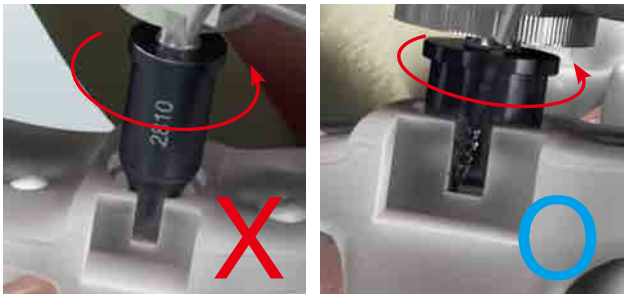
Narrow Ø2.0 diameter drilling is very important to complete the coronal path of the drill. Especially when the guide core is short due to thick gingiva, gradual drilling to secure the depth of a fixture is essential for successful surgery.



Eg) When placing a 11.5mm length fixture
Narrow drill ► initial Drill ► 2nd drill ► 2.0x7 ► 2.0x8.5 ► 2.0x10 ► 2.0x11.5 ► 2.5x11.5 ► 2.8x11.5 ► Final drill ► Cortical bone drill

Slow drilling in a Drill Core

Before drilling, you have to check the guide part of dirll to be inserted into the drill core of guide compeletely. when drill is in right postion, start drilling with recommended RPM [300 ~ 500 RPM]



Slow UP & DOWN Motion

Drilling must be done in the order of increasing the depth of osteotomy and then widening the diameter according to the suggested drilling protocol. Keep repeating up and down motion slowly until the drill stopper touches the stopper position on the guide.

Deliver Fixture as planned

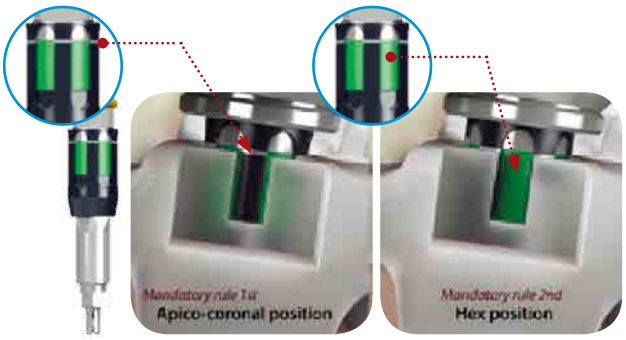
Make sure to connect Handpiece Carrier onto a fixture and deliver it through the R2GATE Guide as planned.

a. Fixture depth control

Align the upper line of the Handpiece Carrier with the Guide Window as [Image 1]

b. Hex position control

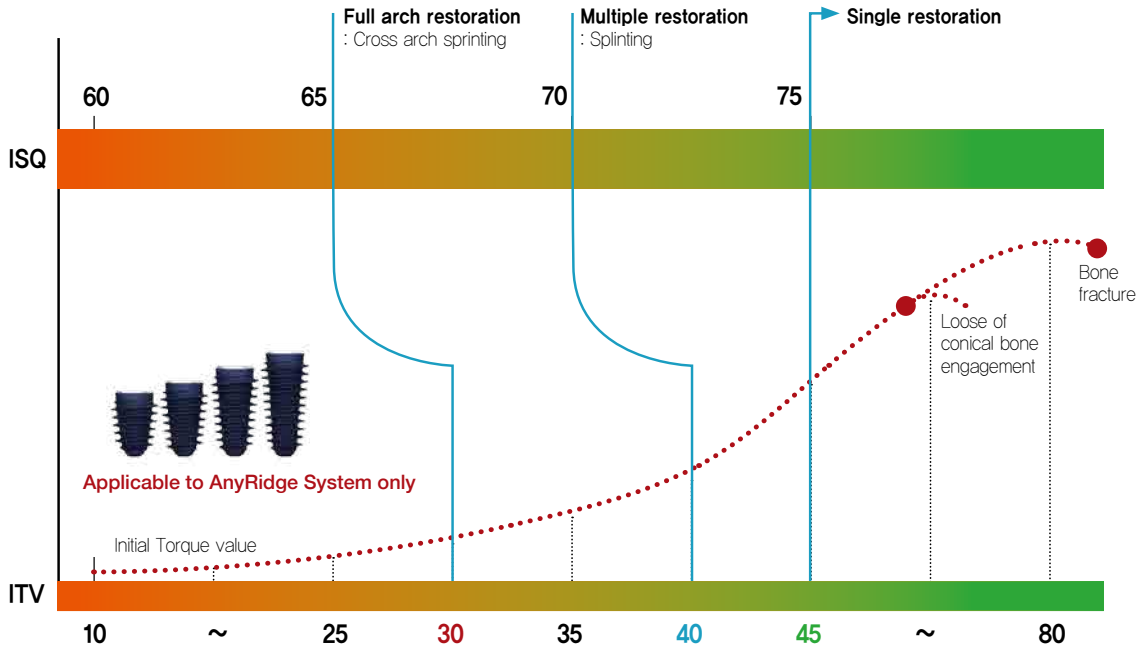
Align the green part of Handpiece Carrier as [Image 2] to make hex position in buccal direction.



[Image 1] [Image 2]

We provide a general standard for immediate loading [ISQ & ITV]

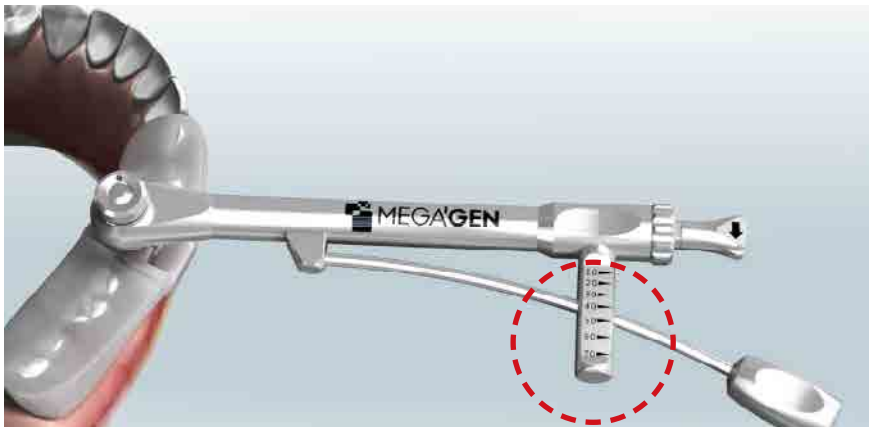
If you use AnyRidge System, the recommended ITV (Initial Torque Value) and ISQ (Implant Stability Quotient) for immediate loading are ITV = 45Ncm/ISQ=75 or above. These values are only for the AnyRidge system and cannot be applied to other systems.



4. Recommended condition for ONE-DAY IMPLANT & immediate loading

According to our own clinical experiences & data, we strongly recommend to check two values : Insertion Torque & ISQ value.

1 Insertion Torque value :
more than 45Ncm



Available on our R2GATE Universal Kit.

2 ISQ value:
more than 75 ISQ value

R2GATE Digital Center

To have stable ISQ value, we recommend to use MEG-TORQ to fasten a smartpeg with 5 Ncm torque force consistently.

R2 GATE Turning imagination into reality

Moment of Choice!

R2GATE®

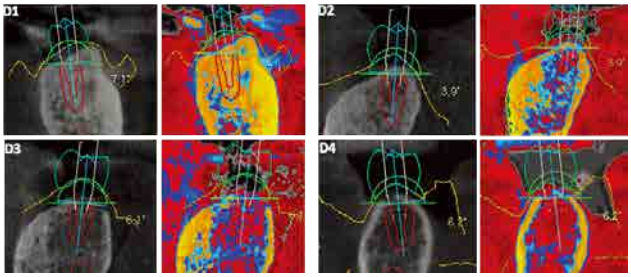
by MEGA'GEN

Experience the future with **R2GATE®**

Blue pill...
stay in the present

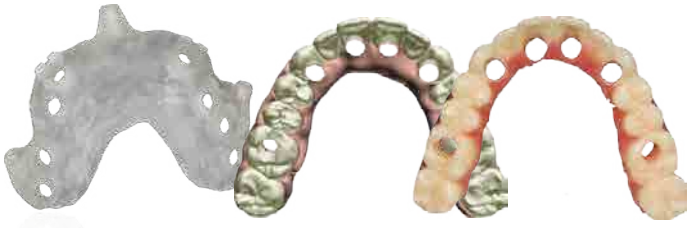
Digital EYE™ ;
Color-coded analysis of bone morphology & density

Although CBCT uses 256 shades of B&W, the human eye can only detect 16(6%). Therefore, Digital EYE converts the CBCT shades into full color with a standardized brightness, allowing intuitive analysis of the bone condition to position & size the implant, determine the drill sequence, and predict the initial stability for immediate loading(ONE-DAY IMPLANT™).



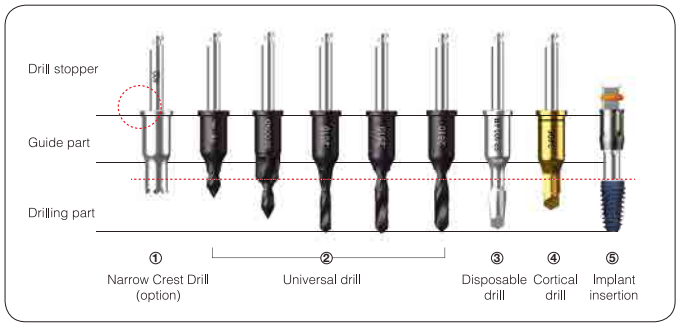
Creating the reality of ONE-DAY Teeth & Digital All-on-4(6)

- accurate diagnosis
- reduced chair-time
- minimally invasive surgery
- immediate loading using digital prosthesis
- excellent clinical results



Convenient drilling system

- All drills combine drill, guide, & drill stopper into one-body
- No need for metal sleeves or spoons!
- Shorter surgery time!
- Disposable final drill provided for each surgery to optimize initial stability



Compatible with all major implant systems

Significant cost savings!

R2 Digital Center

I. Various R2GATE Services

We provide various R2GATE Services. Enjoy them conveniently.

R2GATE® Planning Service

Optimal Implant positioning basis on the TOP-Down concept.

R2GATE allows you to do Prosthetic driven Treatment Planning for optimal positioning of the implant. It provides an eidetic view of all elements that you need for implant practice as CBCT, STL, and Prosthetic design before surgery

R2GATE Guided™ Service

Realize the Tx.planning perfectly.

The surgical guide will be made using state of the art 3D printing technology with the result of Tx.planning. R2 Guide completes your daily implant practice without uncertainty.

R2GATE®

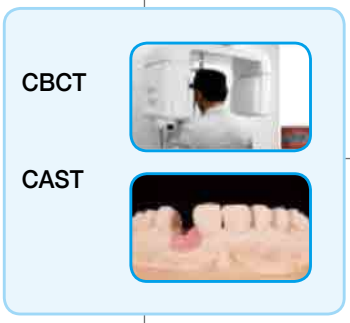
ONE-DAY IMPLANT® service.

Under certain conditions, various prostheses may be delivered on the same day as surgery. Recover function & aesthetics immediately!

II. R2GATE® Order process

Order

1



- CBCT Taking
- Model fabrication.
- Send it to R2 Center.

Implant Planning

2

- Model Scan
- Digital wax-up
- Implant planning
- Send planning file back to Clinic

Caution!

Ask R2 Tray to local R2 Digital Center before placing an order

If a patient is partially edentulous or if there are multiple teeth with metal fillings or restorations, R2 Tray must be used. R2 tray must be sent to R2 Digital Center along with study models and bite registration.

Simple order process : R2GATE Service is very simple,
fast and cost effective.

We have world-wide R2 Digital Center network. Please contact to nearest Digital Center or MegaGen distributors at applicable countries.

User Confirmation

3

- Download project file to R2GATE Lite
- Open project file.
- Modification or confirmation

Manufacturing

4

- R2 Guide Design
- 3D Printing & trimming
- CAD/CAM

Delivery

5

- Packaging
- Delivery

Your confirmation is the most important to shorten the delivery time.

Diagnostic information sent to R2GATE lite can be confirmed.
Corrected and approved data are saved
as project files and transferred to the R2 Digital Center
R2GATE Lite is the essential option for you.

III. R2 Digital Center Network

Please find the nearest R2 Digital Center from your country.

R2 Digital Center HQ
MegaGEN Co.,Ltd, SOUTH KOREA
45, Secheon-ro 7-gil, Dasa-eup,
Dalseong-gun, Daegu, Republic of Korea
TEL : +82 70 4352 1120
FAX : +82 70 7469 1120
E-MAIL : r2gate@gmail.com

R2 Russia Center
DENTAL GURU, RUSSIA
Bid 4312, Pokrovka Str.
Moscow, 105062, Russia
TEL : +7 926 526 2697
E-MAIL : sedov135@gmail.com

R2 Germany center
MegaGen F.D. SA. Germany
Via Valegia 8, 6926 Montagnola, Collina d'Oro, Ticino, Switzerland (HQ)
Ziegeleistrasse 18 | 86860 Jengen (Germany Office)
TEL : +49(151)173 665 97
E-MAIL : stephan.weber@imegagen.de

R2 Japan Center
JOHNNY'S CORPORATION
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R2GATE Lite™

Meet the most innovative implant diagnostic software program in the most innovative way!

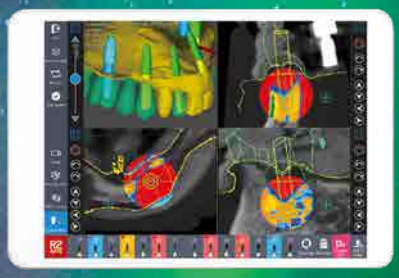
Whenever, Where-ever!

Diagnostic information sent to R2GATE Lite can be confirmed by the dentist immediately. Corrected and approved data are saved as project files and transferred to the R2 Digital center in real time.

Communication with R2GATE Lite™

Throughout consultation about implant treatment with a patient, ensuring the patient clearly understands their oral condition and the future possible outcome of the treatment is a major factor in assuring patient satisfaction. Using R2GATE LITE on IPAD, the doctor can easily show the visual information on treatment planning from diagnosis through to the optimal treatment.

Communication and Design efficiency

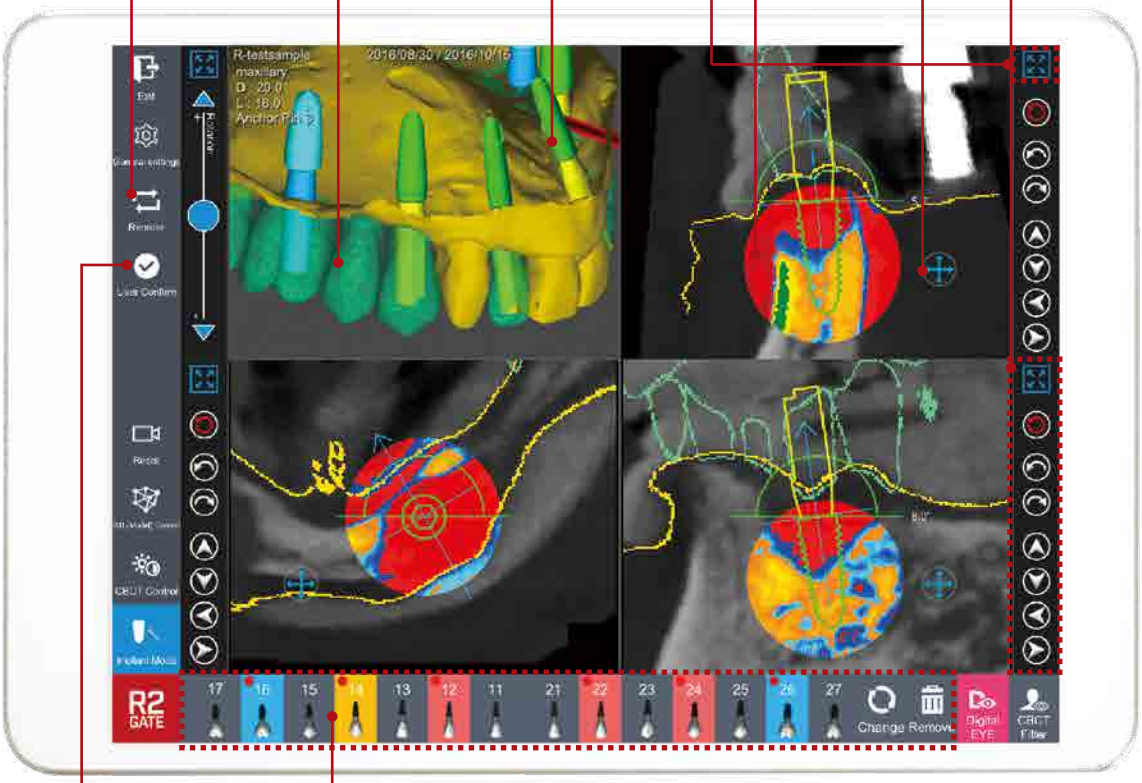


With R2GATE Lite, everywhere it becomes your clinic for you & your patients. You can check, edit, confirm, or send a file to R2GATE Design Center at anytime, and anywhere.

the world's first
Mobile Diagnostic Software

R2GATE Lite™

R2GATE Lite™
Light and Upgrade



You can easily select, add, remove, or modify an implant. Using the international teeth numbering system, you can edit an implant that is currently loaded on the planning.
Pink represents an implant that is already planned, yellow indicates selected implant.
Blue indicates implant newly created implant by user.
Red dot in the selected implant indicates that user has modified the size, position, or angle from initial loading stage.

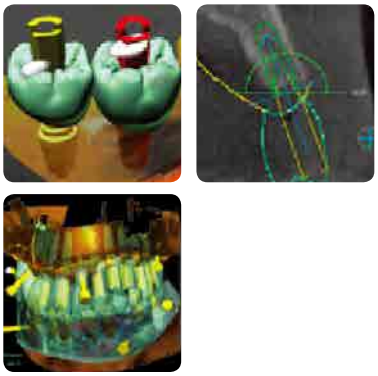
Check
√ Diagnostic wax up
√ Implant position
√ Digital EYE™ - Bone density

Modify
√ Implant position & controls

Confirm
√ Touch to order R2GATE GUIDE

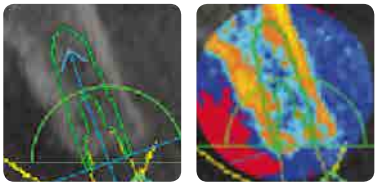
3 essential key factors for implant diagnosis : Bone, soft tissue, teeth

For an ideal implant treatment, cortical bone, soft tissue, and prosthetics must work together.
R2GATE intuitively analyzes and shows the condition of cortical bone and soft tissue, and optimate prosthetic outcome for ideal treatment planning.
For multiple implant cases especially, the distance between implants/platform level and the implant axis angle can be easily understood beforehand for simpler treatment and prosthetic procedure.



Digital EYE™

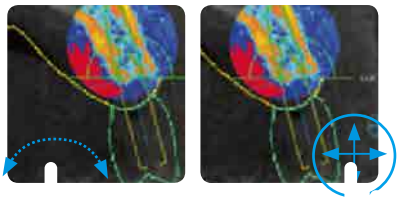
Standard black and white CT analyses the data in 256 shade levels, but human eyes only detect 16 levels with the naked eye.
R2GATE Digital EYE regenerates 256 shades into color to deliver a much more detailed and intuitively understandable guideline of the bone condition.
Also, it standardizes the brightness level that each CT equipment has and provides an objective Houns Field Unit. This significantly differs from the color that other CT data provides.



Easily shift, zoom in, zoom out, rotate with your finger

Easily change the position of the implant wirh your finger.

- Implant rotation: Lightly touch the screen and drag to rotate the implant.
- Implant shift: Lightly touch the ⊕ sign from the lower part of the screen, and drag to move the implant position.
- Zoom in & out: You can easily zoom in & out by using two fingers. Please use the “Moving Key” on the right corner of the screen if accurate adjustment is needed.



Fast and easy diagnosis check

You can confirm the diagnosis immediately by using the "User Confirm" function, or you can send the changes to the center. If you need to revise the model or the implant placement site, you can use the "Diagnosis Reconfirm" function to conveniently receive the diagnosis again.

Auto detecting
All the information that you have done through R2GATE Lite is automatically saved, and all confirmation or modified data will be sent to R2GATE Design Center.


MEGA'GEN
For Lifetime Smiles

Clinical Case Report

Turning your imagination into reality

- Diagnosis & Treatment planning with R2GATE™ and the clinical result
- Understanding and Purpose of Surgical Stent Surgery
- Clinical cases using an R2GATE Guide™ (1)
- Clinical cases using an R2GATE Guide™ (2)

- Author : Dr.Jong Cheol Kim (The investor of R2GATE™)

1. Diagnosis & Treatment planning with R2GATE™ and the clinical result - *Dr. Jong-Cheol Kim*

Implant surgical procedure using guided static surgery

A 68 year old patient presented with the necessity of full mouth reconstruction. Unfortunately, he suffered from pneumonia and had to be hospitalized for about 6 months before the implant surgery. There was partial maxillary bone loss as shown in the panorama below taken before surgery. The patient would need GBR procedure to recover lost bone. At a late stage, the patient and his family changed their minds, preferring minimally invasive implant surgery after the long-term hospitalization due to pneumonia. In this situation, flapless surgery would offer the least invasive option if no GBR treatment was to be carried out. In this case, direct surgery would not be possible, and a blind technique would be required. Under such conditions, most doctors would want to simulate the surgery using all available options - CT images, prognosis program and customized guided drills. This is the story of an approach to guided static surgery converging CBCT (a media device) and CAD/CAM technology through this clinical case.

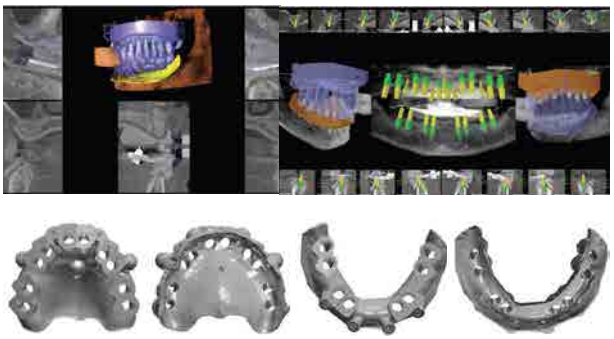
These are the photos and panoramas of the patient's oral cavity after 6 months hospitalization. We need to take alginate or rubber impressions for a full mouth reconstruction using guided surgery. The plaster model is the sent to a digital center which produces the stents. 3 different materials based on the plaster model are sent back to us. Using a wax rim, the operator will decide the implantation position of the upper central incisor, and mark the extension line connected to central line of the face. The facial soft tissue can also be controlled and the bite plane of the deployment angle can be decided by editing the wax rim. We can refer the arrangements of the stent from these procedures. The position of the CR and vertical dimension are decided with a Gothic arch attached to the plaster model. We can decide the so called 'verti-centric' with a Gothic arch.

These pictures show the Gothic arch traces that indicate the movements of the mandible and the stable mandibular position. Proper VD (Vertical Distance) has been decided. Bite material will be poured into the oral cavity with the Gothic arch to record the 'verti-centric', then a CBCT image is taken. The pictures to the right are the CBCT photos with the Gothic arch. Preparation is now complete.

CBCT images are sent to the digital center server online, the Gothic tray containing verti-centric movements, the plaster model and the wax rim with facial information will be also be sent by regular mail. Specialists at the digital center will start mounting on an Articulator based on the received materials. These pictures show the model mounting procedure. The maxillary and mandibular plaster models, the inter-maxillary space and the wax rim information can be digitalized using a dental scanner.

These pictures show the diagnostic wax-up made based on scanned materials by Dental CAD saving a lot of time. All the information regarding the diagnostic wax-up can be opened as a file on R2GATE™ program.

The principle of R2GATE™ developed by Megagen implant Co., Ltd. is layering the DICOM (CBCT) image and the STL file (attained by scan and CAD). By layering the images, we can simulate the implantation based on the prosthetic appliance position seeing the diagnostic wax-up, the plaster model image and the bone condition at the same time. This makes mock surgery using the 'Top-Down treatment' idea possible. The operator's surgical concept can be simulated using two- and three-dimensional images. Below pictures show the simulated implantation of 10 maxillary teeth and 8 mandibular teeth. Another advantage of R2GATE™ is the actualization of the mock surgery results as opposed to other CT viewers which only check the result via a monitor. This simulation result can be extracted as a file that can be used to design with Dental CAD.



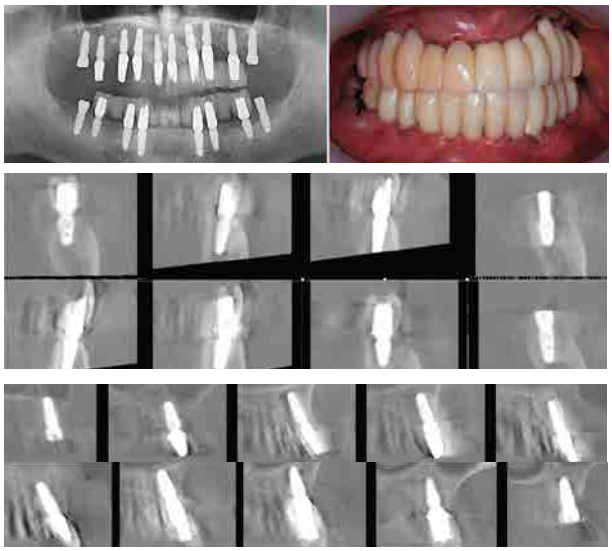
These pictures show the full denture drilling guide designed based on the sources from digital CAD. Not only the drilling guide holes, but also the pin holes needed to fix the stent can be designed. In addition

MegaGen's R2GATE Guide™ is very accurate

the customized abutment and prosthetic appliance can be designed. This means we can recover function and aesthetics immediately by placing the upper prosthetic appliance (if the case of suitable ISQ value) because an upper prosthetic appliance fitting exactly to the implants placed through the customized drill guide can be produced in advance. The CAM method currently attracts more users than CAD. CAM has 2 different ways of manufacturing - milling or 3D printing. This will be expanded in the following pages.

These pictures show the maxillary and mandibular implant drill guides produced by 3D printing. The pictures below show the customized zirconia abutments and temporary crowns produced by milling. As a result, the dentist can receive a drilling guide and a maxillary prosthetic appliance, and may decide whether to connect the maxillary prosthetic appliance or not depending on the ISQ value. The bone can be drilled through the fixed guided stent using anchor pins as you see in the pictures below. This shows the result of flapless minimally invasive implant surgery.

Panoramas and pictures of 10 implants placed using a maxillary stent in the same way. The customized zirconia abutment and the temporary crowns produced in advance were placed after observing a satisfactory ISQ value.
The satisfied CT results can be observed.



Maxillary CT after the surgery

You can check the satisfactory CT results.

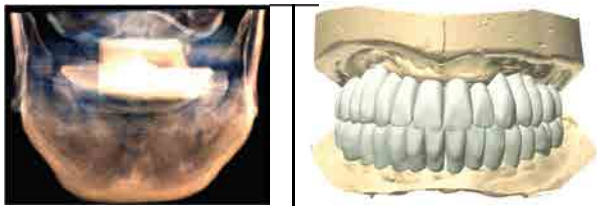
We produced the final prosthesis after 3 months. At this time, the mandible has zirconia abutments and temporary PMMA crowns have been placed in the mandible to allow further recovery of the patient.

This shows panoramas and standard radiographs at 1 month after the final prosthesis was placed. This has been a brief introduction to the general process of guided static surgery using R2GATE™. Due to time & space limitations, this is only an overview - we hope you will be stimulated to ask for more information about R2GATE™ and CAD/CAM. Over the following pages, we will elaborate on the explanation and focus on the prognosis before surgery with R2GATE™, on surgical simulation, and hope that the whole process will be clear.

2. Understanding and Purpose of Surgical Stent Surgery

- *Dr. Jong-Cheol Kim*

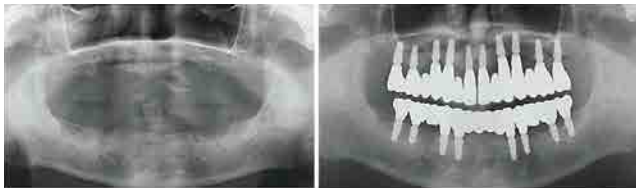
As you can see on the previous pages, R2GATE™'s virtual simulation has the advantage of combining DICOM (CBCT) and STL files enabling the depiction of the overall status of the patient with real time digital videos before commencing surgery. This handy function means that dentists can decide the optimal position for placing implant fixtures and allow a quick overview of the diagnostic wax-up, the soft tissue and the bone. In other words, virtual simulation has reached an outstanding level for finding implant positions as close as possible to real surgery using CAD/ CAM. A simple schematic diagram follows below.



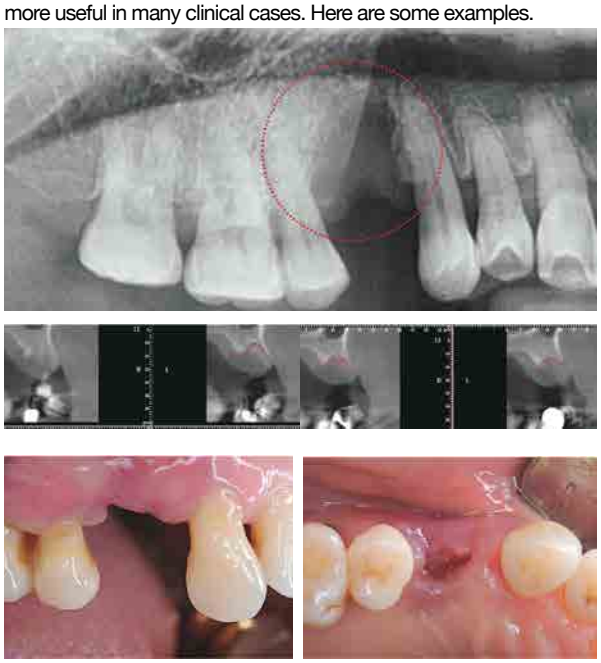
CBCT
DICOM:Digital Imaging & Communications in Medicine

STL
Standard Tessellation Language

R2GATE Guide™ surgery



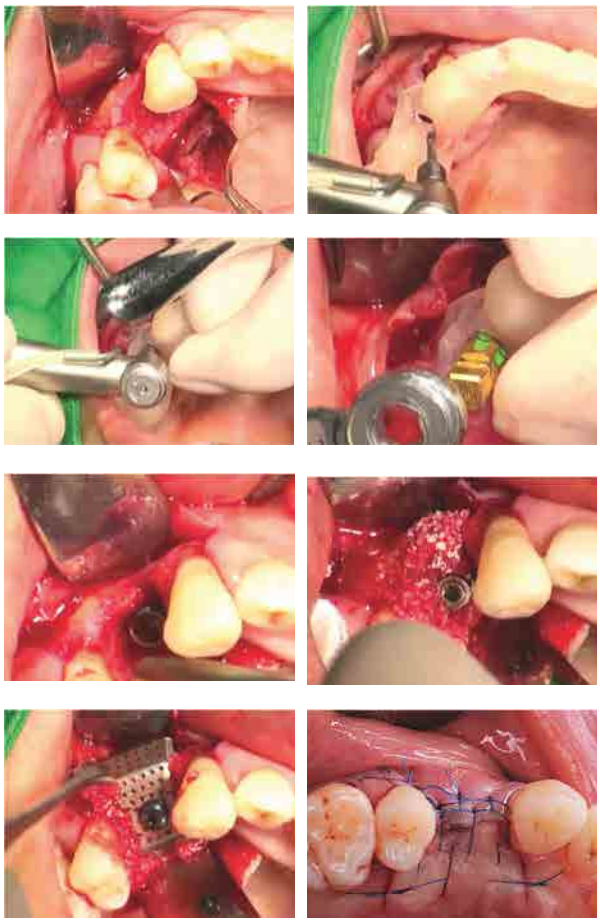
This schematic method of stent surgery can be either 'Open flap surgery' or 'Flapless surgery'. Most clinicians think that 'Guided surgery" means "Flapless surgery". With this concept, the range of clinical applications for drill guides is extremely limited in cases of the lack of hard and soft bone tissue. If instead, one thinks of 'Guided surgery" as correct "implant position', it makes the application much more useful in many clinical cases. Here are some examples.



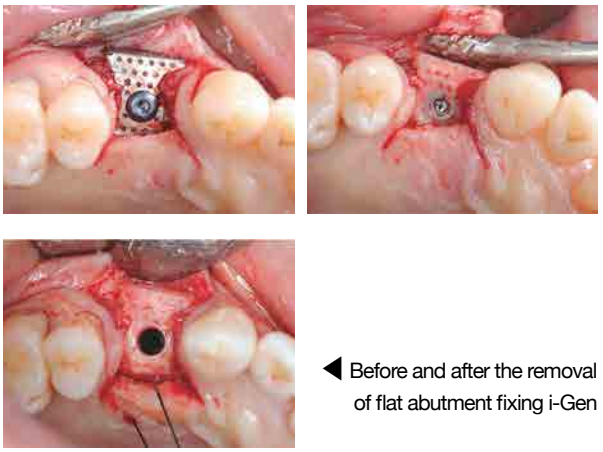
This case is a 56-year-old female with a right maxillary second premolar defect. As can be seen in radiographs, the mesiodistal "Interproximal bone level" area seems adequate, but the faciolingual area shows significant bone loss.

The defect of the mesiodistal space is quite wide, making it difficult to decide the position of both prosthesis and implantation. With R2GATE™ however, true virtual patient simulation procedures can be carried out. The dentist is able to determine surgical options before surgery thanks to the simulation available with R2GATE™.

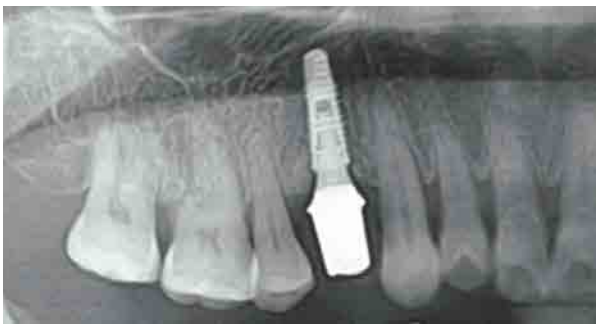
R2GATE Guide™ does a very important role for the implant cases with defects

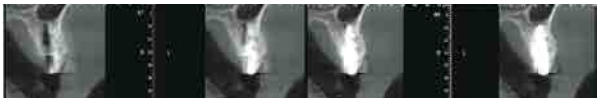


The position of the implants can be determined using R2GATE™ and easily configured – use of an R2GATE Guide™ and Ti-mesh (i-Gen) is decided with the virtual diagnostic procedure. Final suturing is also shown.



◀ Before and after the removal of flat abutment fixing i-Gen





4 months after the surgery

R2GATE Guide™ guided surgery is '3D positioning and realization of implantation' as you can see in the clinical case presented. Over the next pages, we will introduce a variety of clinical cases using an R2GATE Guide™.

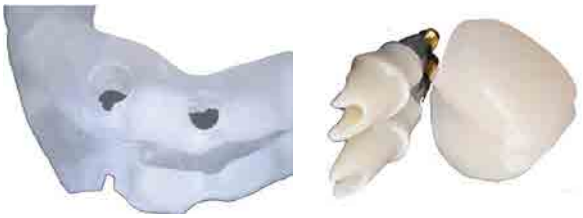
3. Clinical cases using an R2GATE Guide™ (1) - *Dr. Jong-Cheol Kim*

As described earlier, the Clinical Significance of Guided Surgery using R2GATE™ software and an R2GATE Guide™ is 3D positioning and its realization with implants. Now I would like to present some clinical cases using R2GATE™ software and an R2GATE Guide™.

The patient above came to the clinic complaining of movement in the #21 tooth. Cervical caries was immediately identified with the CT. This patient requested rapid, aesthetic, functional recovery over the shortest possible duration of treatments. We planned immediate loading of zirconia customized abutment and a temporary crown, if excellent initial stability could be obtained after implantation using R2GATE™ and an R2GATE Guide™. 2 preparations were needed in the clinic.

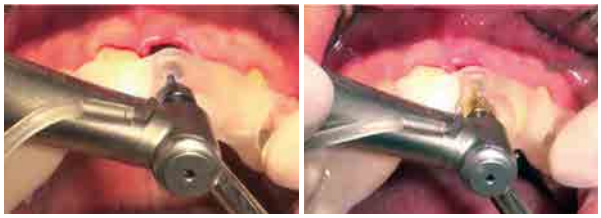
Firstly, an alginate impression of both the upper / lower jaw was taken and stone casts produced. Accurate impressions and stone casts are essential as they are the basis for all the material (data) using R2GATE™.

Second a CBCT scan is needed. As shown in these pictures, the patient bites a unique tray (R2 tray) and the CBCT scan is shot. This R2 tray is utilized as a standard of superposition of the CBCT and the STL files. These 2 processes are preoperative in the clinic. Stone casts can be sent via parcel service and the CBCT file via internet to the R2GATE™ Center.

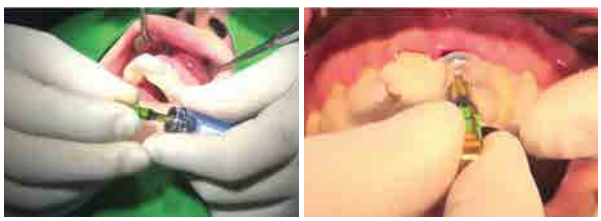


The R2GATE Guide™ and prosthesis are produced with this data.

This R2GATE Guide™ must be placed carefully to avoid damaging the buccal alveolar bone following the tooth extraction.



The drilling may then be performed to the size of the implant using drills exclusive for the R2GATE Guide™ system exactly according to our virtually planned surgery in R2GATE™. As the pictures show, complete drilling processes are recommended to be performed following the guide part of the R2GATE Guide™.



Pick up the implant after finishing drilling, using the hand ratchet connector. The correct combination between ratchet connector and fixture should be accurately checked. The fixture can then be placed in the prepared site after this confirmation.

You can use the R2GATE Guide™ for Immediate Implant Placement case

We recommend the use of an implant motor. Once the implant is almost completely placed with the motor, the final vertical depth and position of the implant should be completed using a torque wrench to match exactly with the virtual plan.

The location of the fixture may be matched to the R2GATE™ plan by matching the window of the R2GATE Guide™ and the black line and green code on the ratchet connector.

▲ The figures above can be applied only to an AnyRidge Implant. These figures cannot be generally applied to other implant systems.

In order to assess the possibility of immediate loading, we use both the placement torque and the ISQ value. Only when using the AnyRidge System, we may try immediate loading – and then only if the placement torque is over 45N and the ISQ value is over or equal to 70 in D3~D1 bone without parafunctional problems.

The pre-made customized zirconia abutment may be connected after bone grafting the gap between the socket and the fixture.

These pictures show the temporary crown, immediately after surgery and then the healed site after 2 weeks.

After time needed for soft tissue healing, the prosthesis can be made using an impression for final prosthesis taken at the customized abutment level.

After 4 months, this is the image of the final prosthesis loaded.
For the success of immediate loading,
1. Bone quality
2. Implant design
3. Surgical technique
4. Occlusal loading control
should all be considered.

Next we will introduce you to how to use the 'Digital EYE™' to assess bone quality using R2GATE™ for surgical planning.

It guarantees a success of an implant through 'Digital EYE™' function even at the poor bone quality

4. Clinical cases using an R2GATE Guide™ (2)

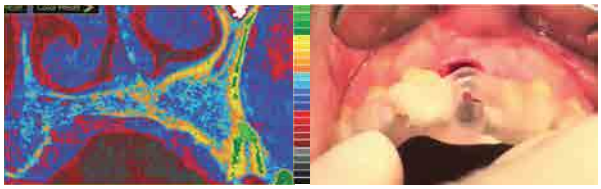
- Dr. Jong-Cheol Kim

At the end of the last article, the necessary conditions for the success of immediate loading were briefly mentioned.

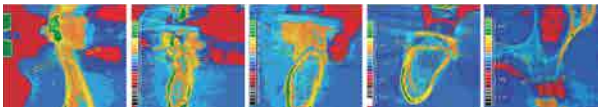
1. Bone quality
2. Implant design
3. Surgical technique
4. Occlusal loading control

Most long-term observational research mentions that the above four requirements affect the success of immediate loading. Utilizing CBCT as an assessment of bone quality is now being introduced in research papers. In evaluating bone quality R2GATE™ also uses a function that enables preoperative evaluation of bone quality and makes it possible to suggest a suitable drilling sequence to increase initial stability.

CT images shown on both the left and right are the same patient's CT image. Depending on the machine, as shown in the pictures, totally different images are created. CBCT is different to MSCT (Multi Slice CT) – it does not apply the HU (Hounsfield Unit) concept. This makes it more difficult to evaluate the bone quality.



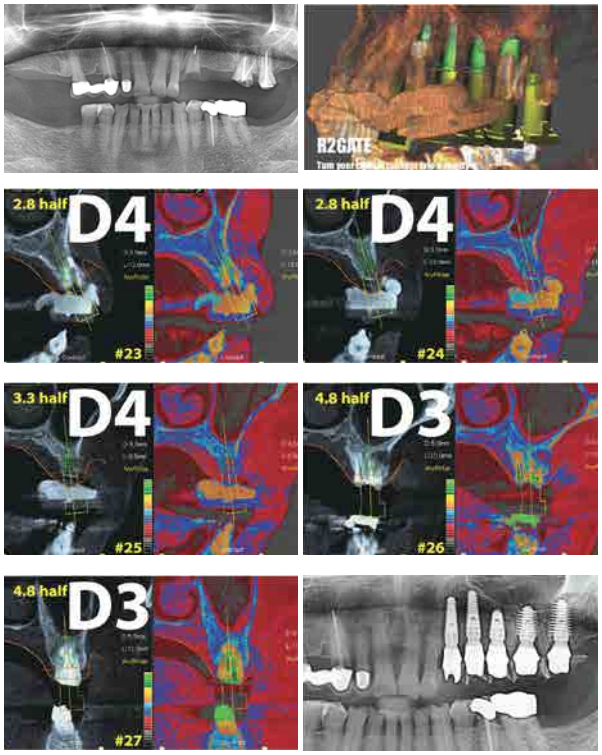
In order to resolve the disadvantages of CBCT, R2GATE™ has installed the 'Digital EYE™'. The colors shown on the image of the soft tissue helps to understand the bone quality thanks to the contrast of color. You may identify the relatively hard cortical bone density and the cancellous bone clearly falls under classification D4 according to Lekholm and Zarb's classification. Considering this bone quality, you might make 2 step under-drilling compared to the planned fixture diameter.



[Ex. 1, 2, 3, 4, 5]

Correct drilling sequence, implant position, and loading protocol can be determined based on CT analysis. Take note though [Example 4, 5] even if initial stability can be gained by determining bone density, do you think immediate loading is always possible?

What are your thoughts, readers?

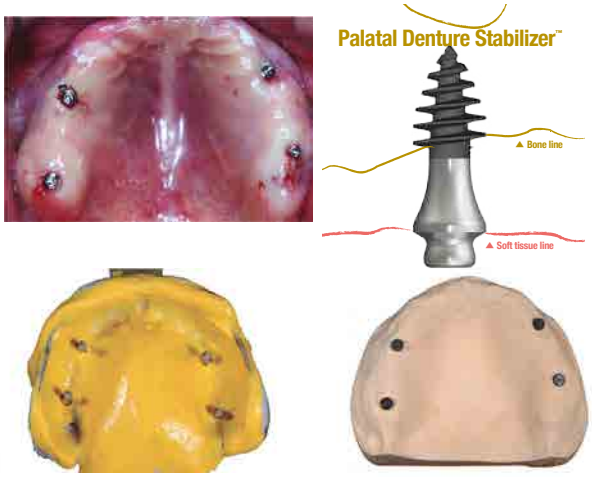


This clinical case used 'Digital EYE™', predicted the bone quality and pre-set the drilling sequence to obtain satisfactory initial stability, and also increased the number of implants for a 'One Day Implant' case. What the ISQ value would be at the time of surgery?

Edentulous clinical cases need restoration and we present another clinical trial. Do you think that a fixation screw is the only way to

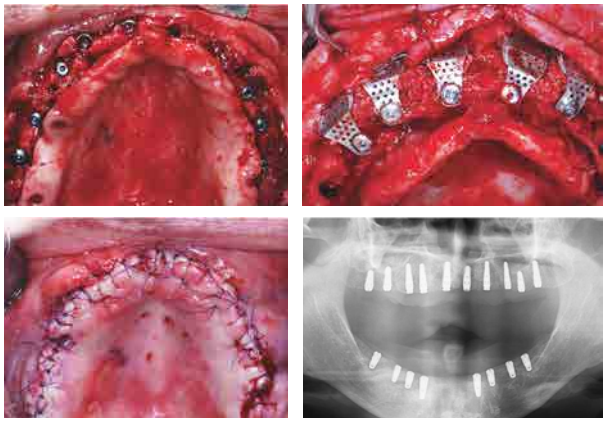
R2GATE Guide™ is very effective for Full Mouth cases, even with thin ridge

obtain stability of the stent when using an R2GATE Guide™ for edentulous cases? Tooth-supported guides have the highest precision. Currently, 'Team Eureka R2' is trying to develop a way to obtain 'Dual stability' by using the Palatal Denture Stabilizer.



One way to change fully edentulous cases to a tooth-supported case would be placing mini implants. Mini implants were originally developed for the purpose of maintaining temporary dentures and the can be used on edentulous cases with R2 surgery. For the mini implant placement, the implant position is not important - simply place it where it can be placed most easily.

Two R2GATE Guide™s can be easily manufactured based on the basic CAD/CAM system. The first R2GATE Guide™ gets support from four mini implants. The method is to place fixtures on areas not related to the location where the mini implants will be placed. Then, a surgical stent will be used to place the fixtures and finally the mini fixtures are removed.



As mentioned in an earlier article, the author placed implants on the basis of the R2GATE Guide™, executed GBR, and made the closure suturing. Once again, the purpose and significance of R2GATE Guide™ surgery is not simply flapless surgery but to virtually manage & observe the result of surgery before the actual surgery following your own clinical philosophy.

'Megagen Eureka R2' started ambitiously with the intention of beginning a 2nd Renaissance in the field of implant treatment and recovery using our own program. The 'R2GATE™' programme is evolving to realize this aim. Next year, we will be able to move beyond the implant field and provide new methods for GBR. In addition, we hope to achieve virtual surgery on the lower jaw using face analysis.

- Courtesy of Dr. Kwang-Bum Park, Dr. Seong-Eon Kim, Dr. Sang-Taek Lee.

*** This clinical case can be viewed on www.R2GATE.com**
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