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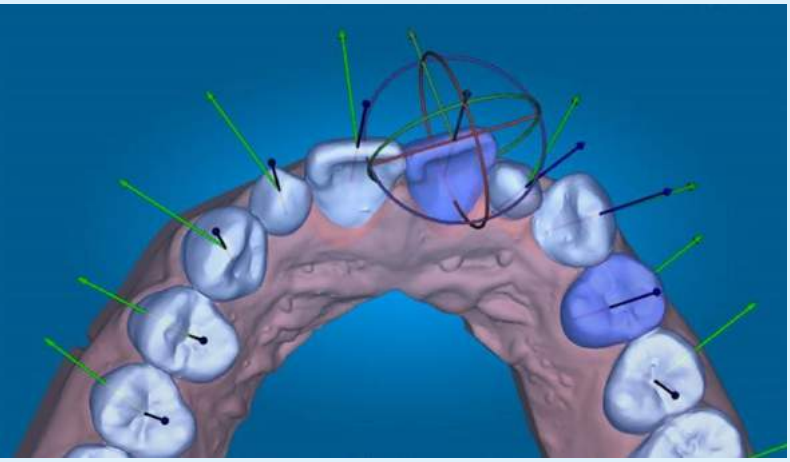
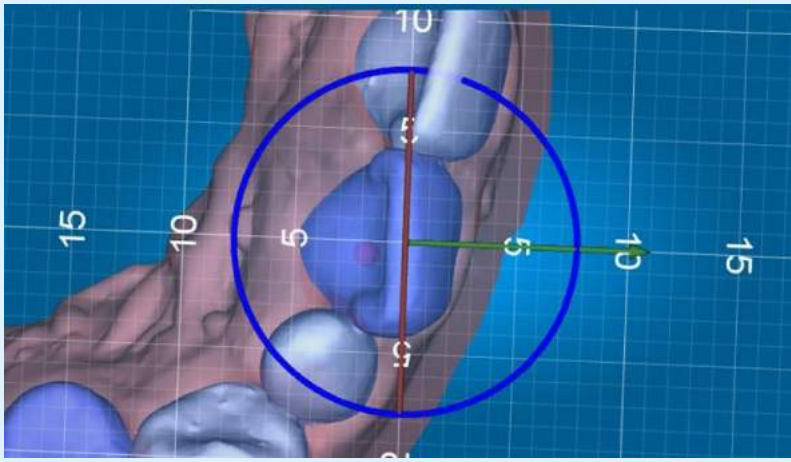
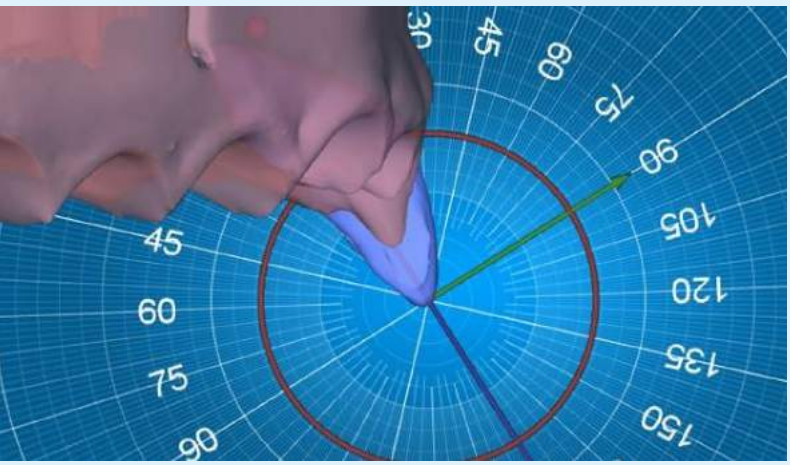
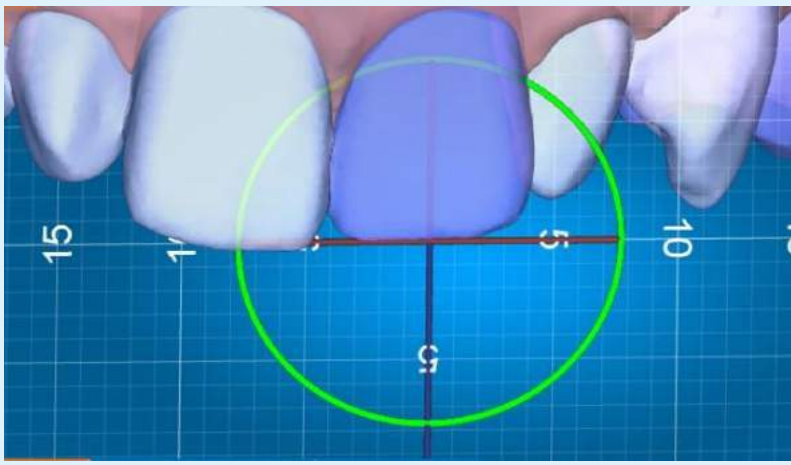
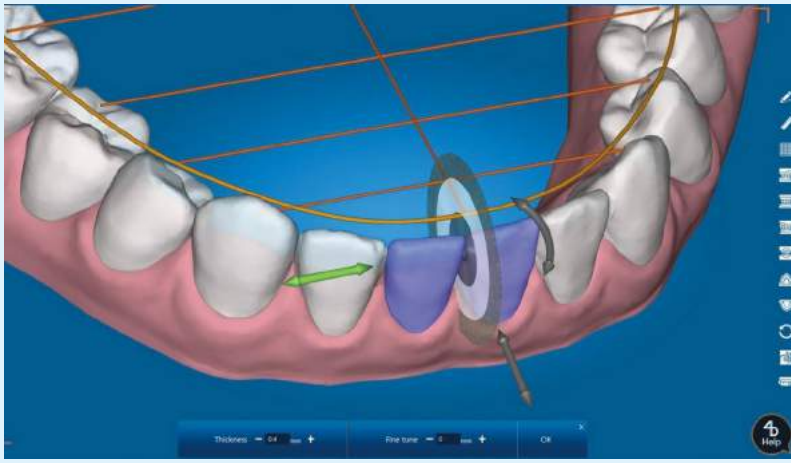
JCDD

Journal of Clinical & Digital Dentistry



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About the Journal

The Journal of Clinical and Digital Dentistry are published four times (March, June, September, and December) annually since May 2019. The abbreviated title is "J Clin Digit Dent". In the journal, articles concerning any kind of clinical dentistry such as prosthodontics, orthodontics, periodontics, implant dentistry and digital dentistry are discussed and presented.

Aims and scope

This journal aims to convey scientific and clinical progress in the field of any kind of clinical and digital dentistry.

This journal publishes

- Original research data and high scientific merit in the field of clinical and digital dentistry.
- Review articles.
- Case reports in implant dentistry including GBR, digital dentistry, 3D printing, and prosthodontics.
- Short communications if they provide or document new technique and clinical tips.

About the Journal

Editorial Board

Editorial

Time to prepare ourselves for tomorrow

I took around 30 international flights a year, carrying out various activities at home and abroad. I was always busy with patients care, lectures, academic activities, and writing activities. However, in 2020, I have not been to the airport since I visited Canada and the US in March due to the COVID-19 pandemic.

At first, having a free weekend was awkward. I slept all day, spent my time with reading books and exercising. Then I decided to take the time to revisit my clinical practice as a dentist until the end of the pandemic.

I reviewed my clinical practice along with the patient data while reflecting on and organizing my treatments. I updated all the PowerPoint files of my lectures, replacing my inability to work abroad. At first, there was regret about the decrease in external activities, but as time went by, the opportunity to look back at my clinical practice and update my activities felt precious.

2020 is almost over already. All the dentists in the world must have had a crazy time this year. Now, for the remainder of this year or in preparation for returning to a normal life after COVID-19, I hope that each of us will have an opportunity to look back on our own clinical practice, organize it, and prepare for new things. I recommend that everyone takes time to read the JCDD released so far.

I think the confusing time of the present will turn into a time of good investment for the future, which in turn will be a good foundation for the future. Even though the COVID-19 pandemic will change the world, it cannot change ourselves as dentists.

Wongun Chang, DDS MS PhD

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Role of the biologic width in implants to prevent peri-implantitis

Woohyuk Yun, DDS, MSD, PhD

Introduction

For quite a long time since the 1980s, there was a period when 1–2 mm crestal bone loss during the first year of the implant in function was considered a natural phenomenon in studies, the most notable one being by Albrektsson [1]. However, as interest and research on the thickness of the tissue around the implant began to thrive, it is now commonly understood that unlike the existence of a biologic width of about 2 mm in natural teeth [2], the soft tissue around the implant has a thickness close to 4 mm, and this is called the biologic width of the implant [3,4]. In addition, it was found that the initial crestal bone loss of the implant, which was thought to be an unavoidable phenomenon, can be prevented if there is a thick peri-implant tissue. This is now accepted as an undeniable fact [5]. In particular, because short implants are increasingly preferred and commonly used rather than GBRs and because a small amount of crestal bone loss can lead to a relatively large bone loss, it is becoming increasingly important to attempt to create the biologic width of the implant to prevent the initial crestal bone loss [6, 7]. With the development of implant surface treatment technology, we no longer have to worry about the success of osseointegration, and as mentioned above, research on the biology of peri-implant tissue has also progressed, leading to an era in which early crestal bone loss can also be prevented. However, it is not the success of the implant, but the long-term maintenance and management of the implant, that is more important. In this regard, the treatment and management of peri-implantitis is becoming more important. It is commonly said that the best treatment of peri-implantitis is its prevention. However, this statement is a paradoxical expression of the fact that there is currently no clear way to treat peri-implantitis once it begins to develop [8] .

Therefore, this report presents the role of the biologic width in implant as a barrier to peri-implantitis.

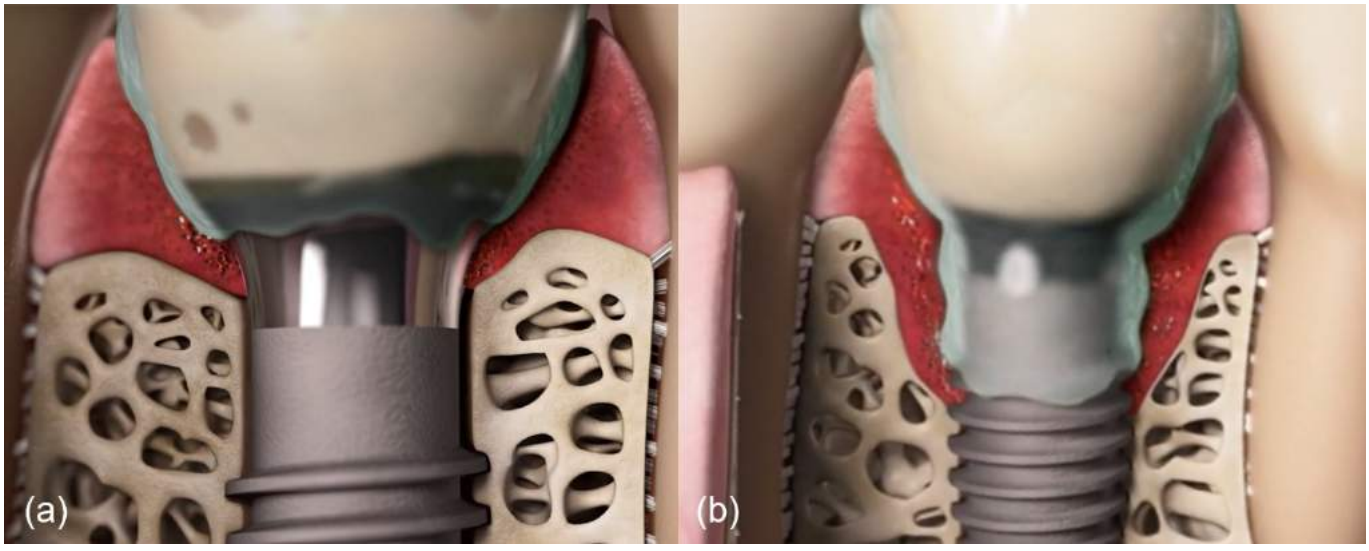

Fig. 1. (a) Peri-implant mucositis (b) Peri-implantitis (quote from EMS YouTube)

Woohyuk Yun

Dr. Woohyuk Yun has graduated from Wonkwang University School of Dentistry in 2004. He had a residency in Periodontics, Wonkwang University Dental Hospital. He gained a Master of Science in Dentistry and a Ph.D in his alma mater. He maintains a private clinic in Namyangju, Republic of Korea.

As mentioned above, there is no disagreement to the statement that the best treatment for peri-implantitis is its prevention. Peri-implant mucositis is the precursor to peri-implantitis, as is gingivitis for periodontitis, and a continuum exists from healthy peri-implant mucosa to peri-implant mucositis and to peri-implantitis. Therefore, management for peri-implant health involves the prevention of peri-implant mucositis and of the conversion to peri-implantitis from this stage to peri-implantitis by treatment of existing peri-implant mucositis [9] (Fig. 1).

The cause of peri implant mucositis is plaque formation with biofilm accumulation [10,11]. However, the term plaque has expanded to encompass biofilms on all oral surfaces. Biofilm requires two important preconditions: a hard surface to adhere to and a fluid environment with bacteria. The oral cavity is ideal environment for biofilm formation. A biofilm will form more easily on the surface of the prosthesis that is surrounded by the tissue encircling the implant. Well-developed biofilms on dental implant surfaces and prosthetic restorations have become the main source of microbes causing peri-implantitis. Thus, controlling the biofilm formation is critical in treating peri-implant mucositis [12].

Biofilm formation on the implant prosthesis is inevitable in the oral cavity. Therefore, the strategy for treating peri implant mucositis is not to prevent the formation of the biofilm but to remove and manage the inevitable biofilm. Treatment of peri-implant mucositis should focus on the management of the preformed biofilm [13].

Currently, there are various mechanical and chemical methods available for removing biofilms (Table 1). However, studies on this topic have concluded that "There is no consensus on the best available treatment for satisfactory implant surface decontamination"[14]. It means that despite the diversity of methods, the best method is still unclear. Biofilm is an invisible cell-level pellicle attached to the surface of the prosthesis beyond the visible plaque level; hence, mechanical removal is not easy. In addition, the biofilm acts as a selectively permeable membrane. Thus, chemical methods are also limited because the biofilm limits the entry of these antimicrobial agents, extracellular enzymes, and toxic components and increases resistance to antimicrobial agents [15]. In 2017, the AAP and EFP's world workshop recommended that "Regular supportive peri-implant therapy with biofilm removal is an important preventive strategy to treat peri-implant mucositis." A specific method was not presented even at such a consensus meeting.

Therefore, I'd like to suggest that the most effective way to resolve peri-implant mucositis is to remove the prosthesis and decontaminate it outside the oral cavity.

This report presents some cases that used this method to treat peri-implant mucositis early stage of peri-implantitis.

- **Curettes of different materials**
- **Ultrasonics**
- **Air Polisher**
- **Laser**
- **Titanium brush**
- **Polishing cup**
- **Tetracycline HCl**
- **Saline solution**
- **H2O2**
- **NaOCl**
- **Cetylpyridinium chloride (CPC),**
- **Chlorhexidine**
- **Triclosan dentifrice**
- **SnFl2**
- **Citric acid ph 1**
- **Local & Systemic**
- **chemotherapeutics**
- **Photodynamic therapy**
- **EDTA**
- **35% phosphoric acid gel**

Table 1. Mechanical and Chemical Surface Decontamination

Case Report

[CASE 1]

This patient visited the clinic with discomfort and bleeding on implants 36 and 37. This is an clinical photo taken after the restoration was removed for the first time in 5 years after the implant was placed due to the inflammation sign of the peri-implant tissue.

The typical aspect of mucositis can be observed (Fig. 2).

The implant prosthesis surface was refastened immediately after decontamination, and recovery from mucositis after about 10 days can be observed (Fig. 3). In this patient, no other treatment was performed except for the restoration removal and decontamination.

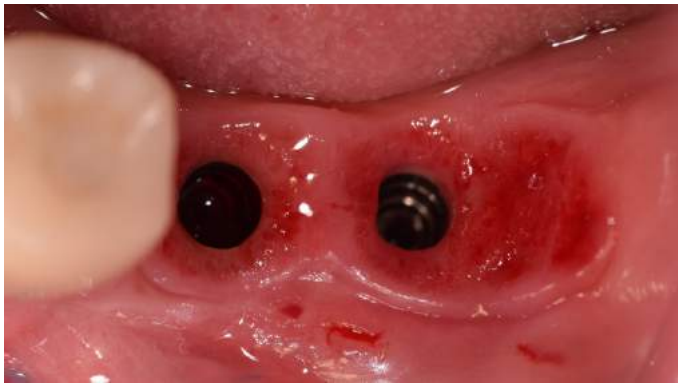

Fig. 2. Clinical photo. This showed the sign of peri-implant mucositis immdiately following restoration removal

Fig. 3. Clinical photo showing the recovery after 10 days of restoration removal and decontamination

[CASE 2]

This case (Fig. 4). is a patient who had peri-implant mucositis on implant 26 and who visited the clinic only after the inflammation had progressed to the point of discharging pus. Decontamination was performed after removal of the restoration without curettage inflamed tissue, and only normal saline irrigation was performed on the inflamed tissue. It was observed at 2 weeks and 6 months that the inflammatory tissue recovered to a healthy tissue. In particular, the implant is well maintained after 2 years without crestal bon/e loss as can be observed in the radiograph taken.

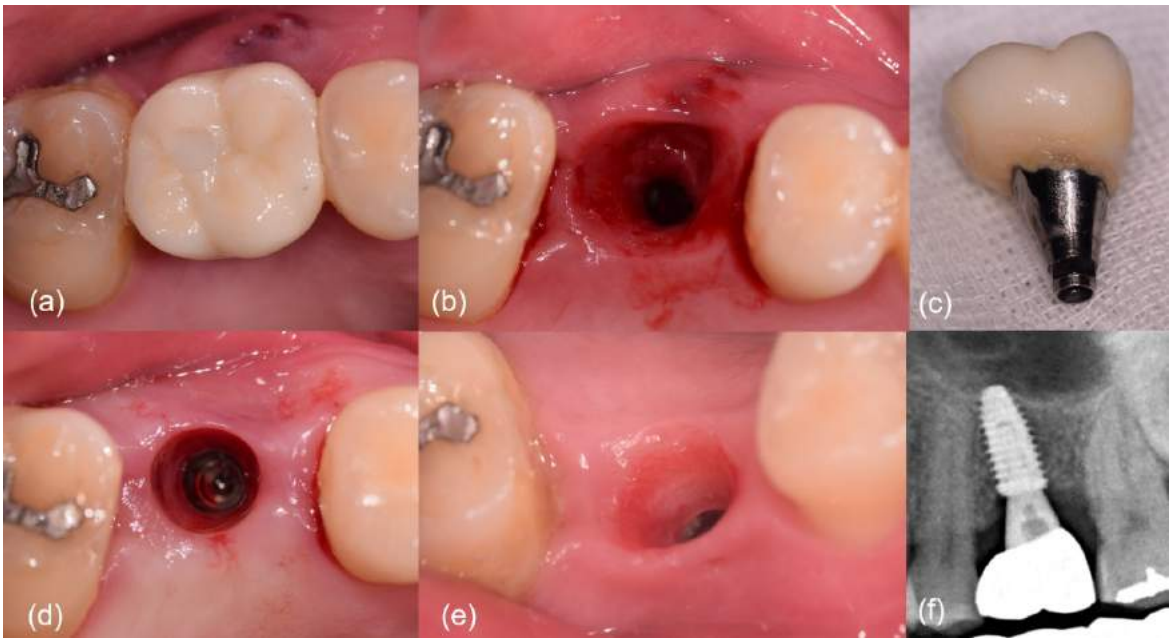

Fig. 4a-f. Treatment of peri-implant mucositis by restoration removal and decontamination
(a) Inflammation with pus discharge in the peri-implant tissue
(b) Clinical view immediately following restoration removal
(c) Plaque accumulation on restoration surface
(d) Inflammation decreased 2 weeks after restoration decontamination
(e) Complete resolution of inflammation 6 months after restoration decontamination
(f) 2 years after treating peri-implant disease. Radiograph view showing no crestal bone loss

This patient experienced severe inflammation without progressing to the loss of crestal bone. It seems that thick soft tissue could played a role as a barrier to peri-implantitis.

[CASE 3]

This patient has been followed up regularly after final restoration. Meanwhile, pt has received supportive implant maintenace therapy for controlling peri-implant mucositis including 3 times of restoration retrieval. In 2019 (6 years follow-up visit), periapical radiograph showed well-maintained crestal bone as if no episode of peri-implant mucositis (Fig 5). This patient had developed mucositis several times, but received regular recall check-ups. The condition was well managed through appropriate decontamination whenever necessary. In this case, it is noteworthy that plaque and food impaction were embedded in the inflamed gum tissue showing mucositis after removal of the restoration. Such plaque that is pressed against the restoration is not easy to remove completely without retreiving the restoration, and it is difficult to confirm whether restoration surface has been meticulously decontaminated.

Even if plaque and food impaction observed in the image were removed, it would have been impossible to remove the biofilm that was not visible on the emergence profile of the restoration that was in contact with the gingiva.

Furthermore, despite a condition of repetitive mucositis, due to thick soft tissue made for the biologic width, the situation did not progress to bone loss and seemed to stay in a state of inflammation limited to mucositis.

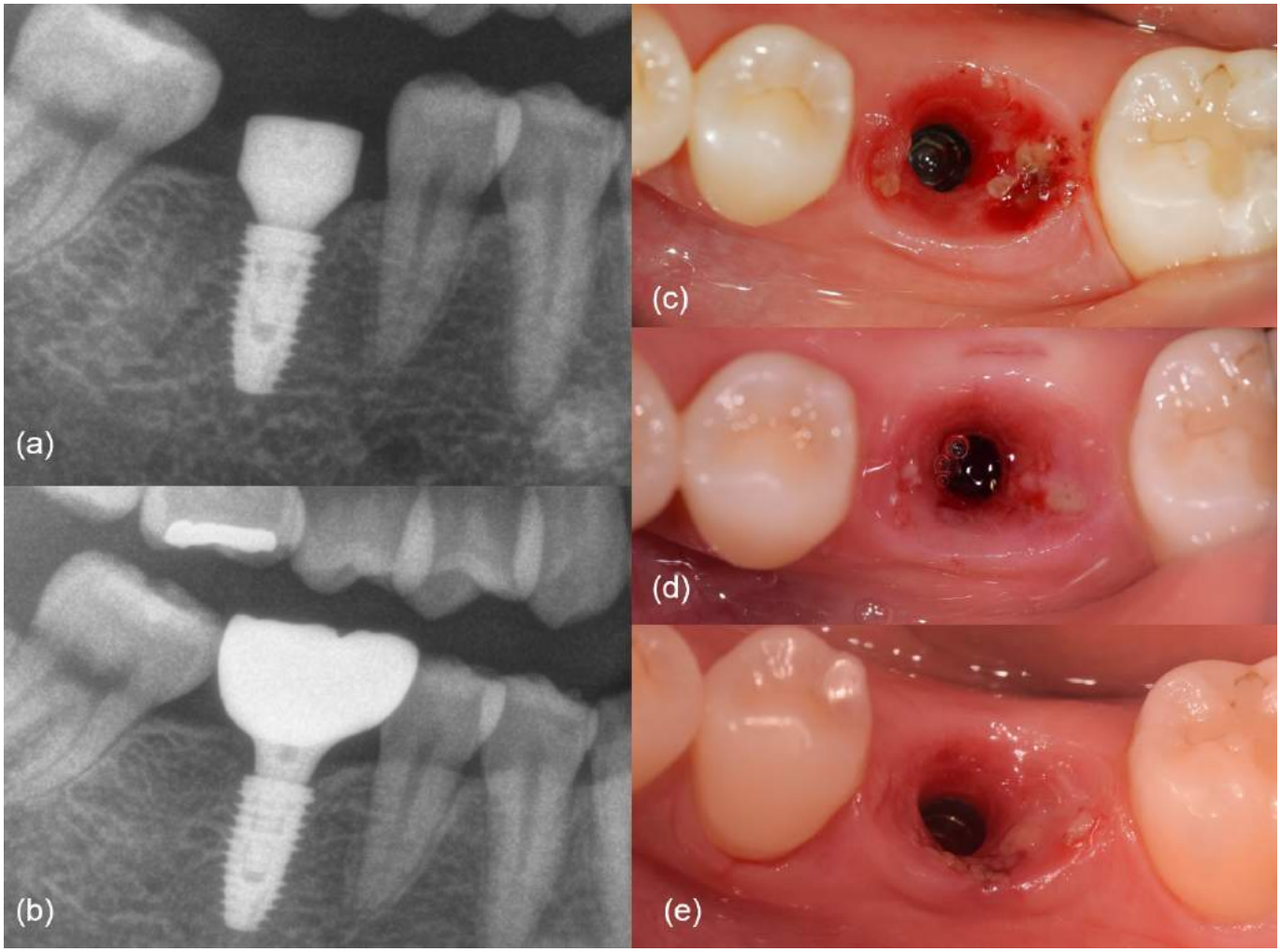

Fig. 5a-e. 6-Year follow-up. Controlling peri-implant mucositis by restoration removal and decontamination
(a) Radiograph after implantation in 2013
(b) Radiograph in 2019. Note no bone loss
(c) Clinical photo.1st restoration removal and decontamination in 2016
(d) Clinical photo. 2nd restoration removal and decontamination in 2017
(e) Clinical photo. 3rd restoration removal and decontamination in 2019

If you have nearly 4 mm-thick tissues around the implant, then inflammation can remain at the peri-mucositis level for a long time compared to a thin tissue, allowing a golden time period to resolve the inflammation at the mucositis level itself (Fig. 6). As a result, simple restoration removal and decontamination prevent the progression to peri-implantitis. If the surface of the implant fixture is contaminated due to crestal bone loss induced by peri-implantitis, it is not easy to treat the condition with a simple method, and the probability of continuing deterioration increases.

Fig. 6. Biologic width as a barrier to peri-implantitis

[CASE 4]

In this case, bone loss could be observed on the radiograph, and inflammation signs such as profuse bleeding on probing, suppuration, and swelling were present in the 5th year after the implant restoration. Thus, we decided to remove the restoration (Fig. 7). It was estimated that the inflammation was not just due to the presence of plaque but also due to an inadequately shaped restoration with closed embrasure (Fig. 8).

After restoration removal, the splinted crown was decontaminated and reshaped to create embrasure, and set again (Fig 9). No additional treatment was performed on the inflamed gingiva except for normal saline dressing. In addition, after re-entry post 3 weeks, it was confirmed that the inflammation of the peri-implant mucosa was resolved (Fig. 10). When followed up at 1 year, a new gingival col that fits the shape of the newly reshaped embrasure was formed (Fig. 11), and after 2 years, the tissues around the implant were in a healthy state without any sign of inflammation (Fig. 12).

Comparing the radiographs after 2 years, complete recovery of the crestal bone around the implant was observed (Fig. 13). It seems that the deminralized because the demineralized bone loss was remineralized again. In addition, even if the bone loss that seems to have progressed to peri-implantitis has already occurred, it is interesting that bone loss in the demineralization stage rather than in the chronic state can be recovered through the process of remineralization with only appropriate treatment at the level of peri-implant mucositis. Demineralization is the process caused by inflammation when mineral ions of hydroxyapatite (HA) are removed from the hard tissues, particularly in the bone. Although HA is one of the most stable calcium phosphate salts, the inflammation process might lead to bone matrix changes following bone loss. Inflammation is related to the overproduction of various cytokines and bone cells. Remineralization might be achieved by increasing osteoblast function; particularly, these cells promote crystal formation of HA, propagate growth in the interior part of membrane-limited matrix vesicles, and induce crystals in the collagenous extracellular matrix, thus mineralizing the bone matrix overall [16-18].

In this case, there was severe inflammation due to the incorrectly shaped restoration and presence of plaque. The inflammation could remain at the level of peri-implant mucositis for long due to the thick soft tissue of the tissue thickness. Although there seemed to be bone loss in the state of demineralization, it recovered reversibly through appropriate treatment and intervention. Insufficient biologic width would be a risk factor to affect more severe bone loss. In addition, if it had already progressed from peri-implant mucositis to peri-implantitis, irreversible bone loss would have occurred and such a reversible recovery would be impossible.

Fig. 7a-c. Peri-implantitis mucositis due to closed embrasure
(a) First visit in 2013
(b) Inflammation of the tissues surrounding the implants in 2018
(c) Radiograph showing crestal bone loss around the implants in 2018

Fig. 8. Immediately after restoration removal- severe inflammation sign due to closed embrasure

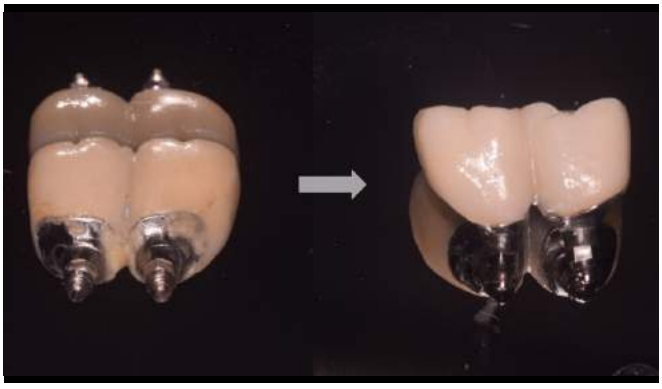

Fig. 9. Decontamination and Embrasure Reshaping

Fig. 10. Clinical view 3weeks after embrasure reshaping and decontamination

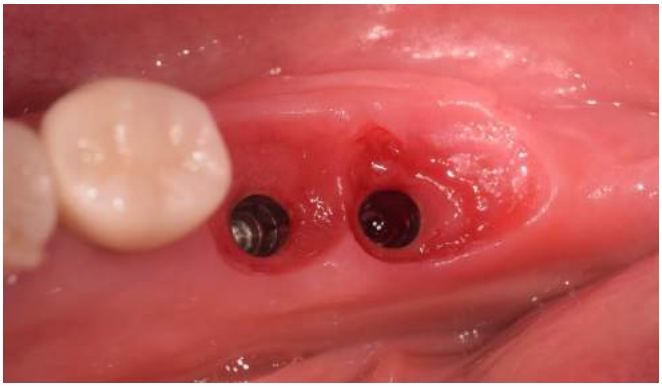

Fig.11. Clinical view 1 month after embrasure reshaping

Fig. 12. Clinical photo showing peri-implant health at 1 year FU after treating peri-implantitis

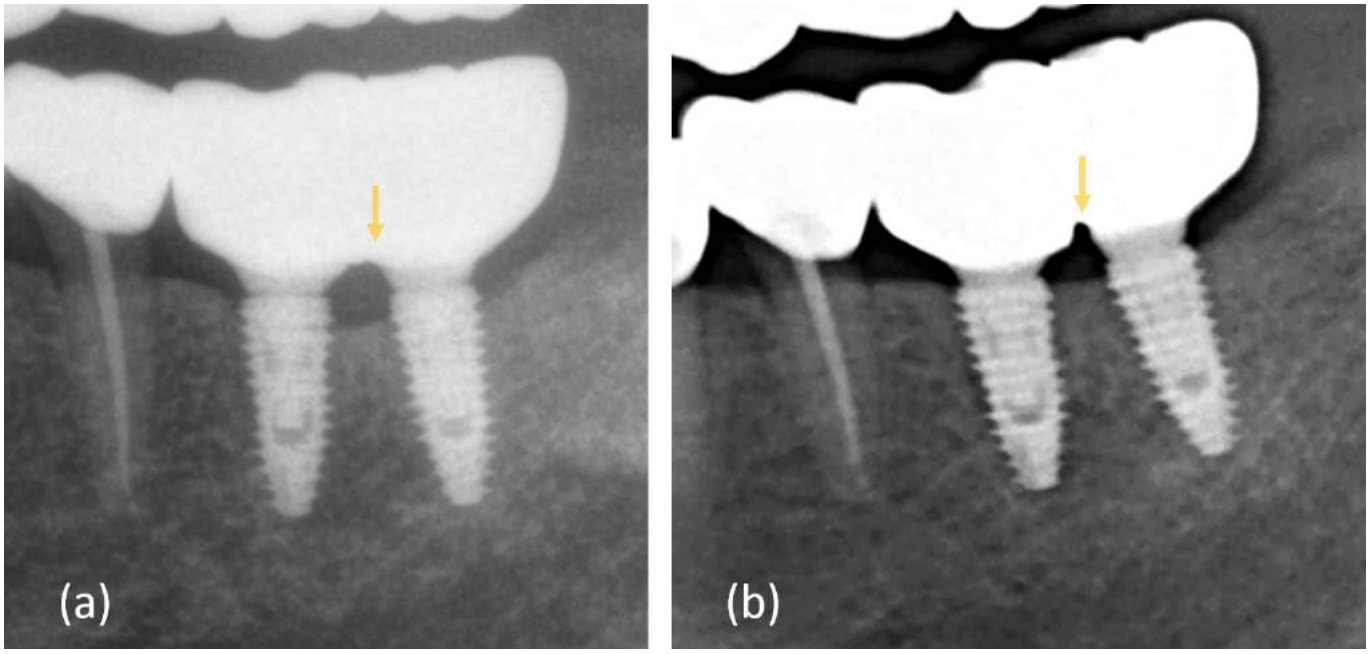

Fig. 13a-b. Radiographic examination
(a) Crestal bone loss around the implant in 2018
(b) 2 years after restoration removal and decontamination. The area that showed bone loss was restored through remineralization in 2020. Yellow arrows showing the marginal bone level change

Conclusion

The best method for preventing peri-implantitis is to treat peri-implant mucositis properly. It can be understood that the appropriate removal of plaque including biofilm is effective in treating peri-implant mucositis. To manage these treatments more effectively, it is important to have thick soft tissue of an appropriate thickness corresponding to the biologic width. This seems to play a role in providing a golden time period when the tissue
can be remained in a mucositis state, thus preventing the peri-implant mucositis from progressing rapidly to bone loss.
In addition, professional supportive care should be provided by adjusting the visit intervals to suit the individual patients, so that inflammation can be detected in a timely manner at the stage of peri-implant mucositis. Patients have to be instructed on their personal oral hygiene with regular monitoring and reinforcement.

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New Horizon of Digital Orthodontic software

DICAON 4D

DENTIS

Interdiscilinary treatment of anterior crossbite with Peg-shaped incisors

Hyunin Cha, BS, DMD

Introduction

Since the clear aligner treatment transfers the orthodontic force by pushing the teeth, it is advantageous for moving the teeth relatively smoothly in the labiolingual direction as intended by the surgeon.Due to the nature of the device, a clear aligner is effective in treating a functional anterior crossbite by the labial movement of the maxillary incisors and the lingual movements of the mandibular incisors. In addition, crowded or rotated teeth can be treated by the planned movement of teeth for each step of the treatment. Peg lateralis is commonly found among maxillary lateral incisors, and prosthetic treatment to resolve the arch length discrepancy of the peg-shaped tooth is required to restore the normal relationship of the anterior teeth after orthodontic treatment. In the case of this study, the anterior crossbite with peg lateralis was managed using an orthodontic treatment with a clear aligner to fix the anterior crossbite and a prosthetic treatment for the peg-shaped incisors. The digital set-up program (DICAO 4D, Dentis, Daegu, Korea) for the clear aligner treatment was used to set up the clear aligner for treatment. The orthodontic treatment was conducted as planned on the program; hence, the normal occlusal relationship of the anterior teeth was restored.

Case Report

The patient had a skeletal crossbite with a class 3 occlusal relationship in the anterior and posterior regions(Fig. 1). The patient wanted that the crossbite of the anterior teeth be improved only by orthodontic treatment without surgery. There was a space in the mandibular anterior region, and the maxillary lateral incisors were peg-shaped. It was planned to move the mandibular incisors in the lingual direction and the maxillary incisors in the labial direction to provide spaces for the mesiodistal width of the lateral incisors. A clear aligner that is effective in inducing the labiolingual movement of teeth was selected for the orthodontic treatment.

*Maxillary occlusal surface: Stenosis of the dental arch was observed (Fig. 2). It was decided to expand the anterior and premolar regions to improve the arch shape and allow the mesiodistal spaces for the peg-shaped lateral incisors.

*Mandibular occlusal surface: The dental arch was rather large in general. Anterior teeth such as incisors and canines (#43) showed a tendency to protrude to the labial side, and there was a gap in between the central incisors. To retract the mandibular incisors as far back as possible, it was decided to perform an interproximal reduction (IPR) between the premolars on both sides and to move the mandibular incisors in the lingual direction to close the gap.

Fig. 1. The patient had a skeletal crossbite with a class 3

Fig. 2. Maxillary occlusal surface

Fig. 3. Mandibular occlusal surface

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Graduated from Kyung Hee University College of Dentistry
Director of DENTIS Institute of Clear Aligner Orthodontics(DICAO)
Developer of setup software DICAON 4D
Main Speaker for DICAON 4D Clear Aligner Orthodontics Setup School

Author of the book:
"The Understanding of Aligner Orthodontics" (2012)
"Clear Aligner Orthodontics (2018)

(1) Import 3D File

Select the folder in which the oral scan file (STL.) of the patient is stored in the left directory path and drag it to the corresponding screen on the right to locate the upper and lower jaw scan files.

When the "OK" button is clicked, the software quickly checks the file and automatically repairs and saves any damaged information (Fig. 4a).

(2) Preparation

A. Re-direction

Since the models input through different scanners are not uniform in orientation (Fig. 4b), the orientation of the model is corrected to facilitate the setup of the clear aligner. On the Re-direction screen, mark three points in the order of the right molar, midline, and left molar (Fig. 5). Take the correct occlusal surface to make sure that the model is not tilted in any of the directions, from the front, left, and right. It is especially important to match the guiding line (three white arch lines) on the maxillary or mandibular occlusal surface.

Align the white line in the middle so that it passes through the central groove of the posterior teeth as much as possible, and adjust the line to make sure that it is not slanted toward the left or right teeth. Predict and match the line to let the incisal edges of the target virtual mandibular incisors pass through the central white line (Fig. 6).

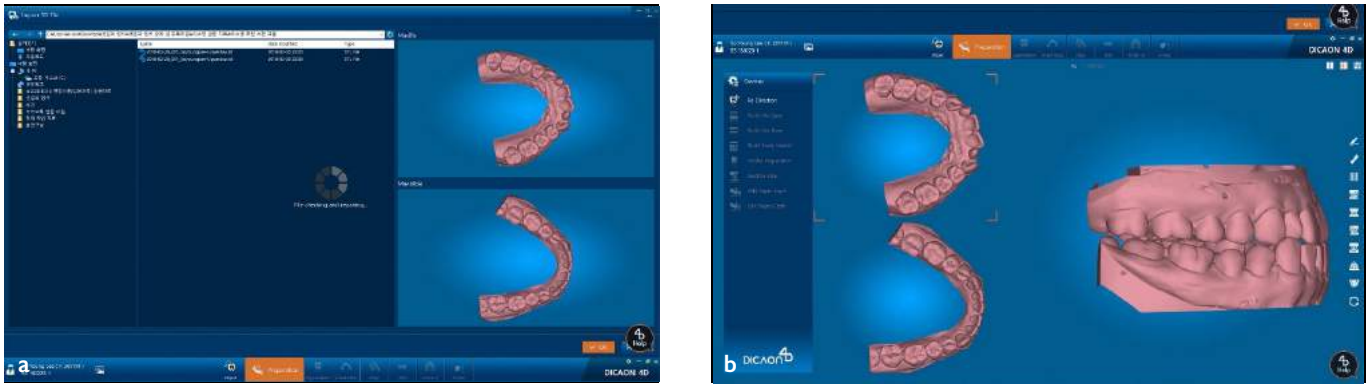

Fig. 4a-b. (a) The file and automatically repairs and saves any damaged information
(b) The models input through different scanners are not uniform in orientation

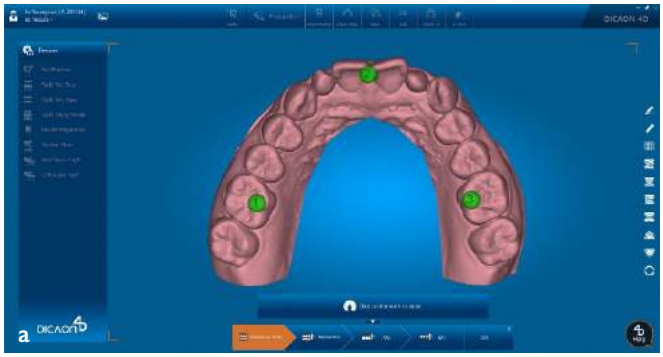

Fig. 5. Mark three points in the order of the right molar, midline, and left molar

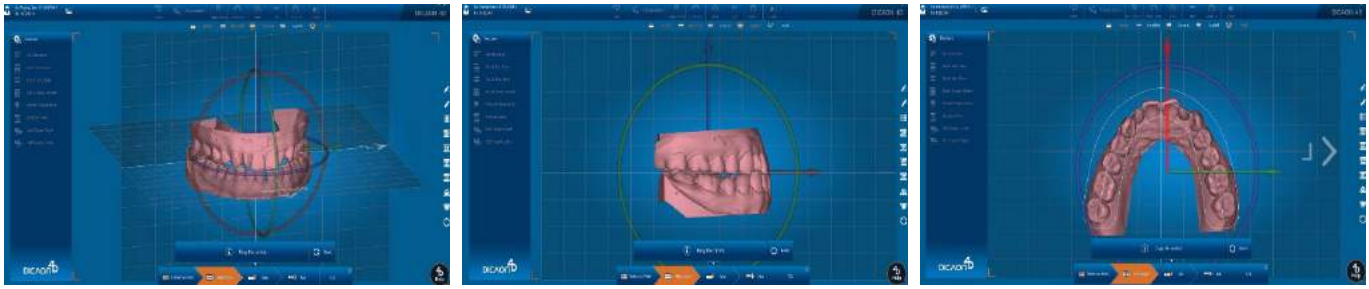

Fig. 6a-c. Predict and match the line to let the incisal edges of the target virtual mandibular incisors pass through the central white line

B. Build Base

Make a 3D shape for a convenient CAD work by blocking the bottom of the film-like scanned surface (Fig. 7)

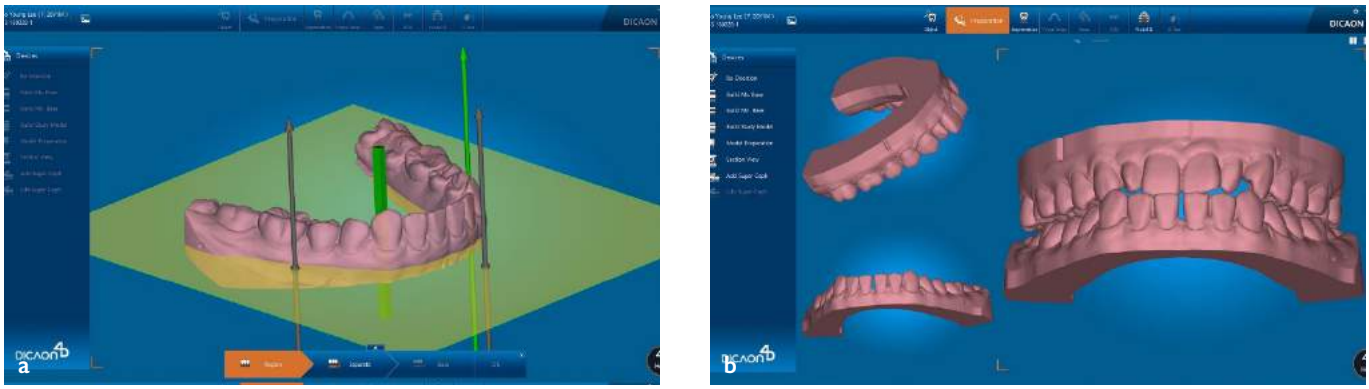

Fig. 7a-b.

[Initial Model Analysis and Setup Planning]

Establish a virtual setup plan by looking at the state of the maxillary and mandibular occlusion and dentition in the initial model after preparation. Based on the occlusal relationship, select the teeth to move and the teeth to keep in place, and devise concrete methods for implementing the treatment plan established at the time of the initial clinical diagnosis. This can be easily carried out using the "Free Draw" function in the software (Fig. 8).

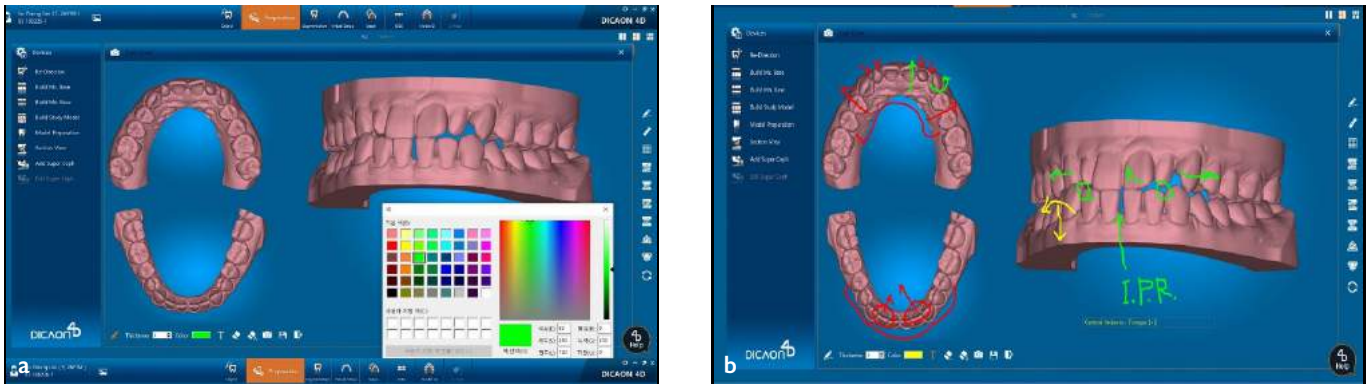

Fig. 8a-b. "Free Draw" function in the software

(3) Segmentation

Since the scanned model is only the 3D data in which the teeth and gingiva are connected to each other without distinction, it is necessary to separate the teeth from the original data to move them, which is called segmentation. The process of segmentation consists of measurement, margination, and axis setting. The teeth that are not included in the segmentation process are recognized as part of the gingiva by the software such that they are pulled and distorted like soft tissue when moving the adjacent teeth. Therefore, more adjacent teeth should be segmented along with the target teeth for the setup.

A. Measure

Separate the teeth within the setup range according to the specified direction (#17⇒#27, #47⇒#37), and click the two points on the mesial and distal marginal ridge to coincide with the imaginary mesiodistal axis. Mark these two points very carefully because if the positions of the points are more accurate, less errors will occur in the setting of the gingival compartment, muscle, or distal axis in the next step.

The teeth are numbered automatically. To change it, click on the tooth number and assign a new number in the selection window (Fig. 9).

Fig. 9. To change tooth number, click on the tooth number and assign a new number in the selection window

B. Marginate

Although the tooth separation line is well located along the gingival margin of each tooth, manually drag, create, or delete the dots on the separation line by clicking them for more precise segmentation (Fig. 10).

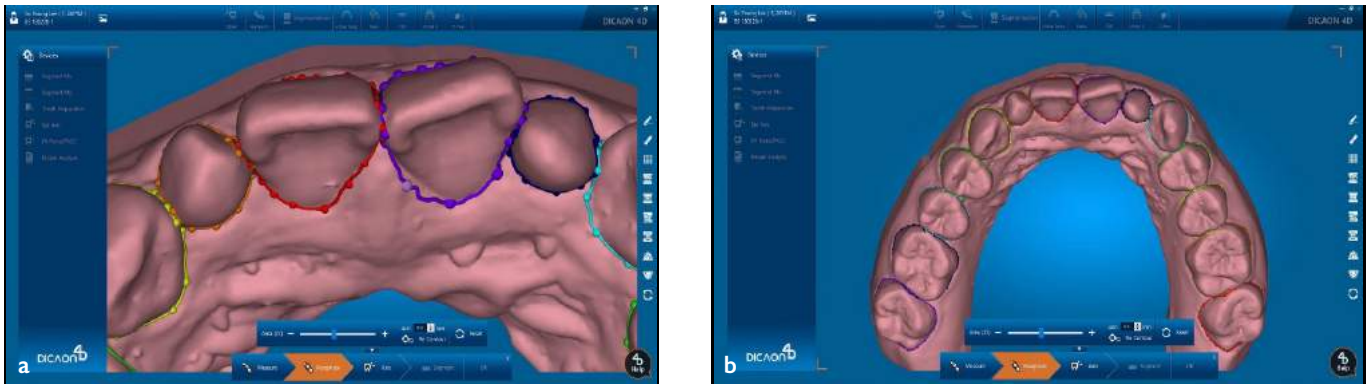

Fig. 10a-b.

C. Set Axis

Adjust the muscle, mesiodistal axis, and long axis of the tooth for it to be moved accurately. Specifically, for the setup of the long axis, imagine the shape of the root to carefully keep it in place so that it can rotate in a regular circle for rotation.

The purple dot represents the axis of rotation or center of rotation (CRo), which is automatically set to approximately 15 mm below the tooth amputation or cusp tip. To adjust the magnitude of tipping, click it to move it up and down. There is a function that can be used to hide adjacent teeth so that one tooth can be observed from the mesiodistal direction to imagine the position and shape of the root, which is very helpful in correctly setting the long axis (Fig. 11).

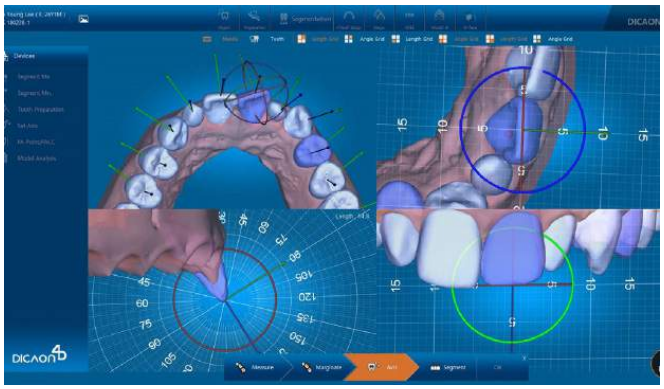

Fig. 11.

(4) Virtual Setup

A. Occlusal Plane

Prior to moving the teeth around, reset the accurate occlusal surface of the segmented teeth. This determines the horizontal and vertical directions of each tooth as well as the three-dimensional position of the arch line and symmetric line when setting the movement of the tooth (Fig. 12).

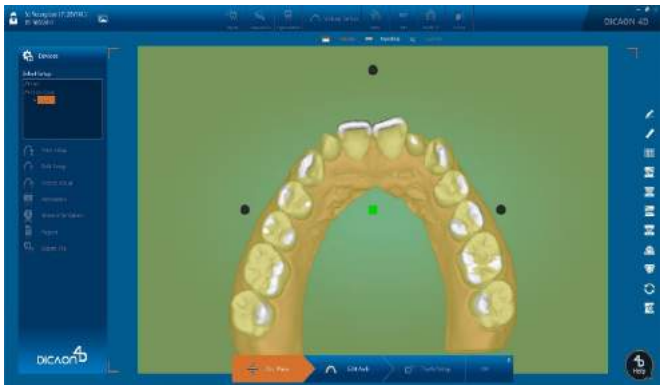

Fig. 12.

B. Edit Arch

The arch line setting function guides the precise setup to achieve the goal of the orthodontic treatment by displaying the ideal (normal) dental arch for the patient on the 3D screen prior to the virtual movement setup.

The arch line can only be adjusted on the maxillary model. Match the anterior region to the mesiodistal axis of the target virtual incisal edge, and place the midline, which will be the axis of symmetry of the entire set of teeth, in the desired place. Adjust and match the shape, size, and position of the arch line to let it pass through the central groove of the maxillary anterior region and the buccal cusps in the mandibular posterior regions (Fig. 13).

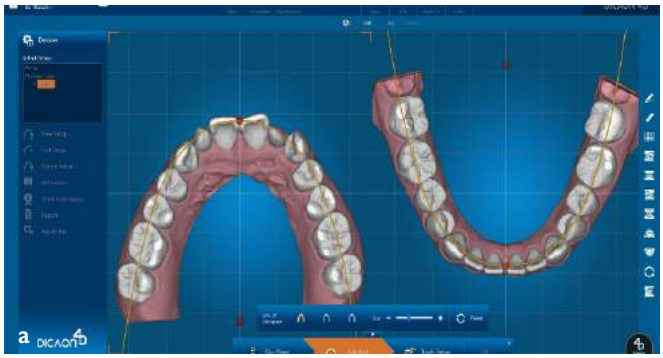

Fig. 13. In this patient, the maxillary and mandibular occlusal relationship was opposite to the normal occlusal relationship. Since the positions of the maxillary and mandibular teeth are determined according to where the target arch line is placed, it is important to establish a rational relationship between the maxillary and mandibular teeth. The mandibular teeth should be placed more toward the lingual side than toward the incisal edge by adjusting the arch line, making it smaller than the current arch; the maxillary teeth should be placed more toward the labial side than toward the incisal edge by adjusting the arch line, making it larger than the current arch. The red ball should be accurately placed at the target midline

C. Tooth Setup

Except for a very simple case, most setups involve layers. The layer function is not to set the teeth and move it to a target position at once, but to move them step by step and systematically to meet the complex clinical reality using two or more screen layers.

The maxillary teeth of this patient needed to be aligned by expansion. This process can be simulated using layers by assigning a mission to each layer for the efficient execution of the orthodontic treatment. In the first and second layers (Fig. 14), the arch is expanded from the left premolar to the right premolar.

At this time, slight rotation, torque, and tip are incorporated to reduce the burden of arrangement in the subsequent finishing layers. Since the central groove of the premolars was located on the lingual side of the arch line, the premolars were also boldly included in the expansion along with the incisors for the overall expansion of the arch.

B. Build Base

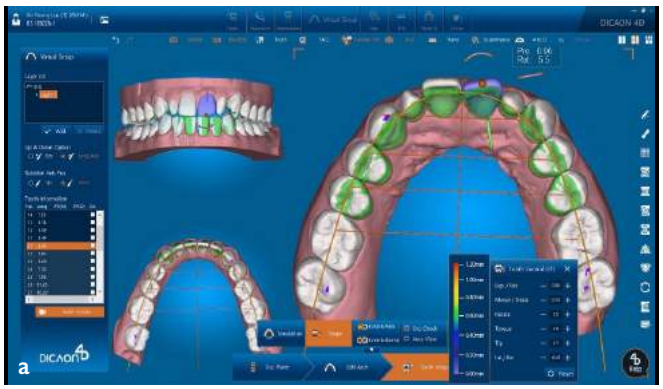

Fig. 14a-b. The teeth before the movement (initial) are marked in light green in the first layer (a), and the teeth after the movement (setup) are displayed in white. The direction and distance of tooth movement can be estimated by comparing the overlapping areas based on the color difference before and after the orthodontic treatment. The color marking indicates that the teeth are expanding toward the labial and buccal sides

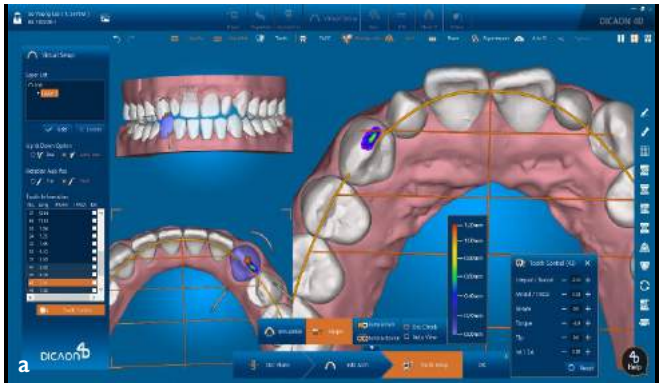

Fig. 15. During setup, teeth, which are hard tissues, may overlap due to prematurity, and care should be taken to prevent such unrealistic virtual mixing. When it occurs, the level of hard tissue overlap (displayed by color) must be precisely identified and setup by using the "Automatic Color Spectrum Chart" that helps the occlusion check

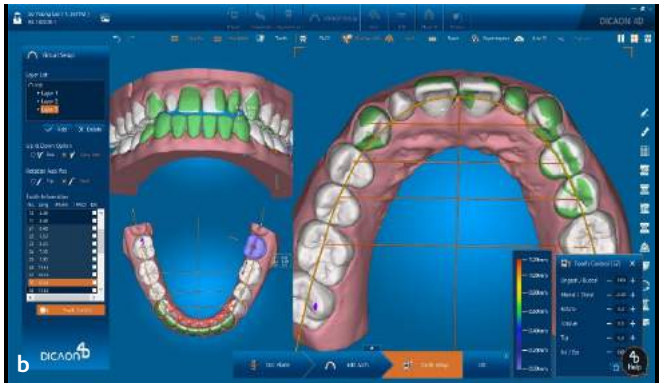

Fig. 16. In the third layer, the crooked teeth are rotated in earnest to complete the final arrangement. The color difference indicates that the canine teeth (#13 and #23) and the left central incisor (#21) have been rotated in earnest

The mandibular teeth are also setup to move simultaneously along with the maxillary teeth by setting a layer according to the movement of the maxillary teeth. Contrary to the movement of the maxillary teeth, the mandibular incisors are retracted toward the lingual side as much as possible to fix the crossbite.

Prior to the retraction toward the lingual side, in the first layer, teeth with irregular mesiodistal axes (Fig. 17a) are rotated to coincide with the arch and finely moved in the mesial direction to evenly arrange the interdental spaces for the efficient and retaliating movement of the teeth (Fig. 17b). At the same time, adjustment (torque and tip) of the inclined long axis of the tooth is also added to be completed as much as possible before the retraction toward the lingual side.

Fig. 17a-b.

In the second and third layer, the final arrangement is completed by boldly retracting the teeth toward the lingual side to fit the arch line set as the goal of the orthodontic treatment (Fig. 18). Setting up with such properly designed layers prevents mixing and locking in the process of moving the teeth. At this time, the arch acts as a guide to make sure that there are no errors in accurately rotating the teeth distorted in the direction of the mesiodistal axis or in arranging teeth that are incorrectly positioned to meet the ideal arch line.

Fig. 18a-b. In the last layer (b), a slightly excessive retraction is performed in the lingual direction to induce an interdental overlap (indicated by the value in the orange box), which is an over-correction to make sure that the interdental spaces are completely closed to prevent relapse.

Fig. 19a-d. Since interdental spaces are required for full-scale retraction of the mandibular teeth in the lingual direction of the second layer, interproximal reduction (IPR) is performed prior to the setup. It is desirable to create a space, considering esthetic improvement as much as possible, when determining the area to be reduced. Since the occurrence of a black triangle was expected due to the shape of the mutual proximal surface between the left and right central incisors, such an unaesthetic result was prevented in advance by appropriately reducing (shaping) this area and then performing retraction in the lingual direction (1 → 2 → 3 → 4).

(5) Steps Creation

A. Build Model

The setup data set in layers is divided into a step-by-step model suitable for sequentially mounting the clear aligners (Fig. 20). In this process, it is desirable to carefully consider the method of operating the thickness of the aligner in each step, the period of orthodontic treatment required by the doctor or patient, and the situation and cooperation of the patient.

B. Check of Occlusal Relation Change

Check the step-by-step changes in the maxillary and mandibular occlusion using the "Show All Model" function (Fig. 21). The crossbite initially diagnosed has been fixed into a normal bite through the "bite jump" between the maxillary and mandibular teeth.

Fig. 20. The setup data set in layers is divided into a step-by-step model suitable for sequentially mounting the clear aligners

Fig. 21a-b. Check the step-by-step changes in the maxillary and mandibular occlusion using the "Show All Model" function

Start the orthodontic treatment by making a clear aligner with the printed setup model and attaching it in the mouth of the patient (Figure 22). The form of the steam in the device indicates that the labial and buccal teeth, and the entire gum area are lifted as the maxillary aligner is pushing the teeth from the inside to the outside, and that the labial and buccal gum areas are lifted due to the resistance of the teeth as the mandibular aligner is pushing the teeth from the outside to the inside.

Fig. 22. Making a clear aligner with the printed setup model and attaching it in the mouth of the patient

Comparison of occlusion conditions before and after the orthodontic treatment. Proclination of the maxillary incisors, space closure, and movement of the mandibular incisors in the lingual direction restored the normal relationship of the incisors (Fig. 23). When comparing the teeth before and after the orthodontic treatment by drawing a yellow baseline, dramatic changes in the shape and position of the maxillary and mandibular teeth can be observed. In addition, a space corresponding to the width of the normal lateral incisor was created at the mesiodistal center of the left and right peg-shaped lateral incisors as intended for the maxillary region (Fig. 24).

Fig. 23a-b. Comparison of occlusion conditions before and after the orthodontic treatment

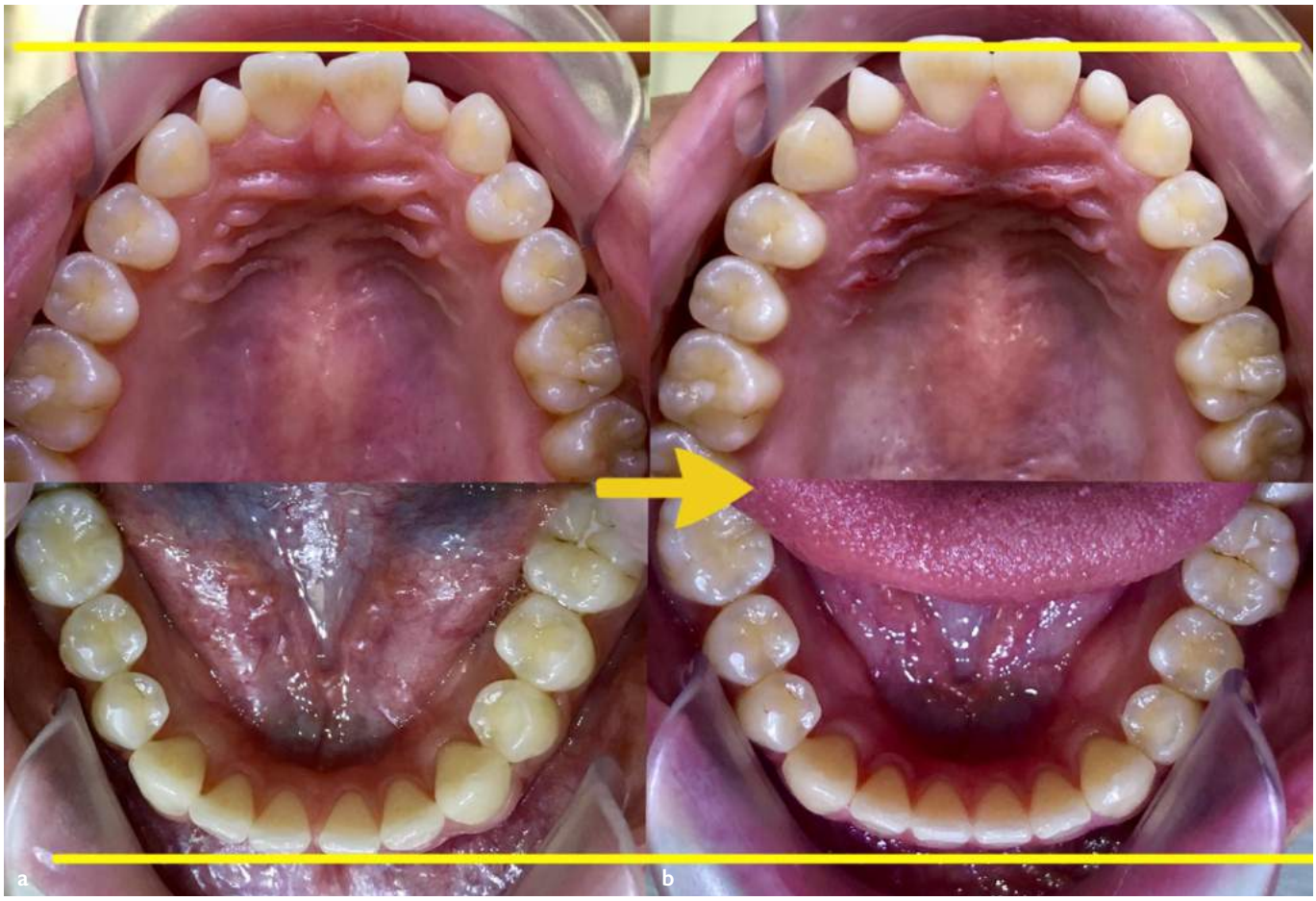

Fig. 24a-b. A space corresponding to the width of the normal lateral incisor was created at the mesiodistal center of the left and right peg-shaped lateral incisors

At the end of the orthodontic treatment, abutment preparation is performed for the esthetic prosthetic treatment of the peg-shaped maxillary lateral incisors. For functional and esthetic recovery through the prosthetic restoration of the lateral incisors, the lingual side of the abutment is reduced much, while the labial side of the abutment is slightly reduced to maximize the effect of labial movement for the restoration with the esthetic prosthesis (Fig. 25). If the proximal surfaces of both teeth of the esthetic prosthesis are irregular, a black triangle teeth of the esthetic prosthesis are irregular, a black triangle occurs even after the dental crown procedure, which is unaesthetic. The proximal surfaces were reduced with a mechanical diamond strip as part of the enameloplasty procedure for flattening the adjacent surfaces on both sides (Fig. 26). After acquiring the abutment impression, a temporary crown was fabricated in the clinic and temporarily bonded while the final prosthesis was being (Fig. 27).

Fig. 25. At the end of the orthodontic treatment, abutment preparation is performed for the esthetic prosthetic treatment of the peg-shaped maxillary lateral incisors

Fig. 26. The proximal surfaces were reduced with a mechanical diamond strip as part of the enameloplasty

Fig. 27. Temporary crown was fabricated in the clinic and temporarily bonded

Putting the temporary crown on the peg-shaped tooth, which is originally small, increases the volume, such that the clear aligner currently in use does not fit. Therefore, a hole of an appropriate size should be made considering the size of the temporary tooth to allow the aligner to fit well as it did before (Fig. 28).

The size and shape of the hole should be carefully considered to prevent a relapse in the teeth under orthodontic treatment (Fig. 29: pink arrows). An esthetic prosthesis was fabricated and set in the oral cavity (Fig. 30).

The incisal edges of both lateral incisors, compared to those of the original teeth, were made to protrude more toward the labial side. The color and shape of the crowns naturally harmonized with the adjacent teeth. Comparing the images from before and after the orthodontic treatment, and before and after the prosthetic treatment, it can be seen that the treatment has proceeded smoothly according to the plan established after the initial diagnosis (Fig. 31).

Fig. 28. A hole of an appropriate size should be made considering the size of the temporary tooth

Fig. 29. The margin of hole should be carefully formed so as not to cause a relapse(Pink arrows)

Fig. 30. An esthetic prosthesis was fabricated and set in the oral cavity

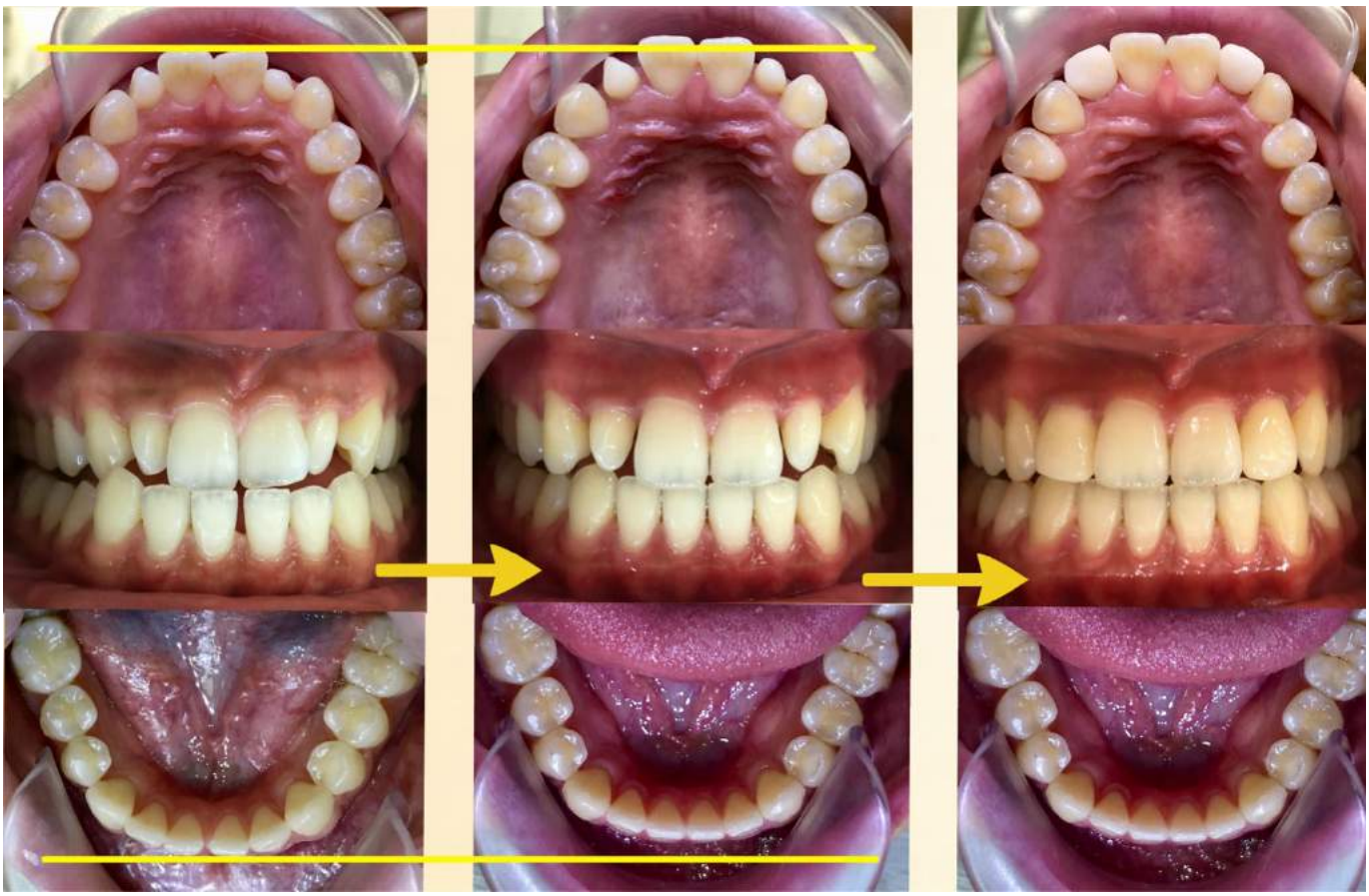

Fig. 31a-c. Comparing the images from (a)before (b)after the orthodontic treatment (c) before and after the prosthetic treatment

Conclusion

The satisfaction of the patient with dental treatment was maximized by combining clear aligner treatment using DICAON 4D and prosthetic treatment using esthetic restorative materials.

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Various GBR techniques are possible with only one kit!

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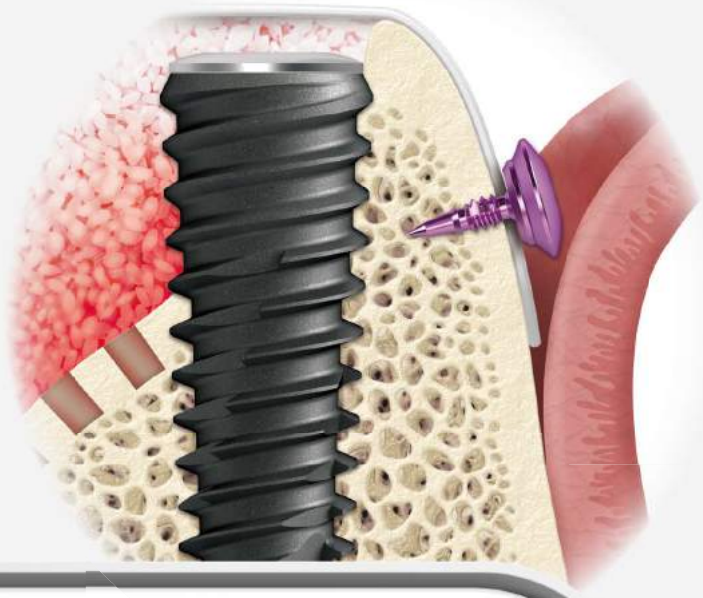

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Sinus Floor Elevation using Dentis SAVE SINUS Kit : Bone Packing and Spreading Method

Yongkwan Choi, DDS, MSD, PhD

Introduction

The methods of performing sinus floor elevation include the lateral approach and the crestal approach. Of these, I will focus my talk on sinus floor elevation using the crestal approach, which is more commonly applied in clinical practice.

Sinus floor elevation using the crestal approach dates back to 1994, when Summers first introduced bone-added osteotome sinus floor elevation (BAOSFE) (Fig. 1). If the height of the residual alveolar bone was lower than 5 mm, the lateral approach was indicated. If it was higher than 5 mm, the crestal approach was recommended. Reiser et al. reported that the use of the BAOSFE method allowed mucosal elevation up to a height of 4 to 8 mm (Fig. 2). If 5 mm of alveolar bone remains at the placement site of a 10 mm implant, it is possible to lift the sinus floor by the crestal approach, as it requires an elevation of about 5 to 6 mm. As BAOSFE proposed by Summers is a method of pushing bone graft material in a vertical direction from the sinus floor using an osteotome, there is a higher risk of perforation of the sinus mucosa compared to other methods, especially if elasticity of the sinus mucosa is degraded for various reasons or if excessive force is applied due to poor force control in the manipulation of the osteotome. Moreover, the possibility of developing a type of dizziness, called benign paroxysmal positional vertigo (BPPV), due to the malleting process, has been steadily raised. Therefore, personally, I do not prefer this method.

Recently, various implant companies have developed and marketed a variety of sinus floor elevation devices, and these products are being widely used clinically. Among them, I would like to introduce to you a method of performing sinus floor elevation using the SAVE SINUS kit by Dentis (Fig. 3).

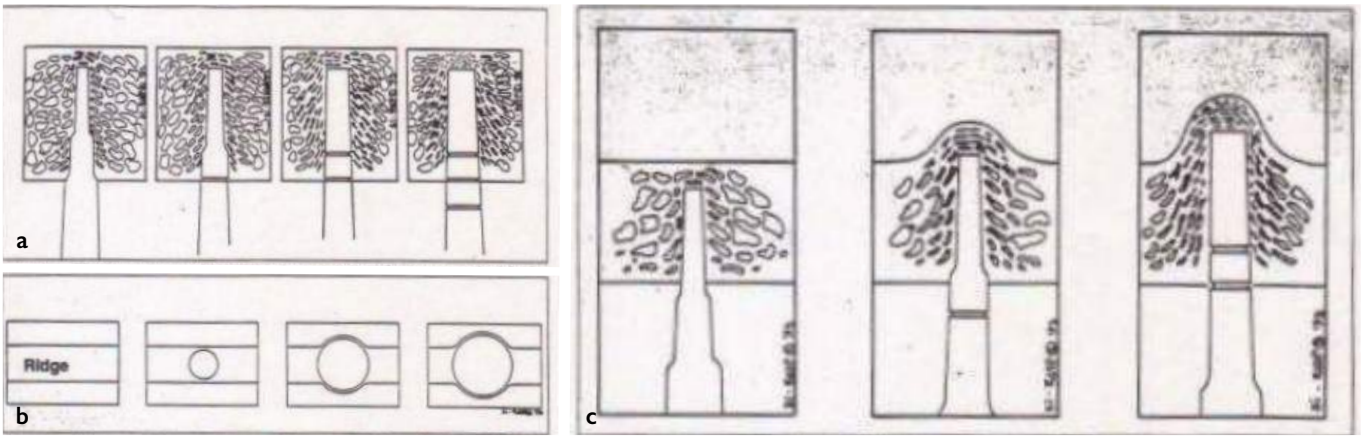

Fig. 1. (a) The bone layer adjacent to the osteotomy is compacted with the osteotome technique
(b) Ridge expansion osteotomy can be attempted at any location wider than 3mm, Buccal and lingual bone moves laterally as the osteotomes are inserted
(c) The osteotome sinus floor elevation(OSFE), Bone piles up in front to be displaced upwards

Yongkwan Choi

Dr. Yongkwan Choi graduated from Dankook University School of Dentistry. He received MSD and PhD in his alma mater. He completed a residency training at the Department of Oral and Maxillofacial surgery in Denkook University Dental Hospital. His clinical focus is a sinus surgery, implant surgery, and a digital dentistry nowadays. His goal is to become a good mind excellent surgeon. He practices at LA Dental Clinic, Seoul, Republic of Korea.

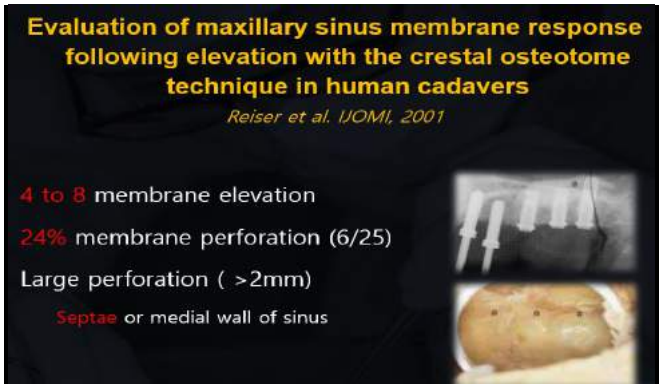

Fig. 2. Reiser et al. reported that the use of the BAOSFE method allowed mucosal elevation up to a height of 4 to 8 mm

Fig. 3. SAVE SINUS KIT

After measuring the exact length from the alveolar crest to the lower margin of the sinus by conducting a preoperative radiographic examination, start the osteotomy with an initial drill (Fig. 4) connected with a stopper at about 1 mm shorter than that. Then, depending on the diameter and bone quality of the implant to be placed, connect a stopper to an SD reamer with a diameter of 3.6 to 4.1 mm, to increase the general width of the bone removal site (Fig. 5). Next, set the drill speed to between 500 to 800 rpm, and continue drilling by increasing the length of the stopper by 1 mm. During this process, when the SE reamer meets the lower cortical bone of the sinus, you may feel a little resistance. Subsequently, the resistance caused by the cortical bone suddenly disappears and the cortical bone in the lower margin of the sinus opens up. The height at this time, which is the drilling depth when the lower margin of the sinus opens up, is very important as it becomes the reference point for elevating the lower margin of the sinus step by step, later on.

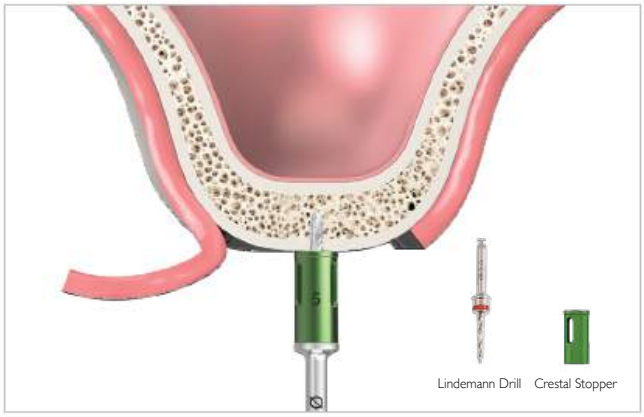

Fig. 4. Initial drill connected with crestal stopper

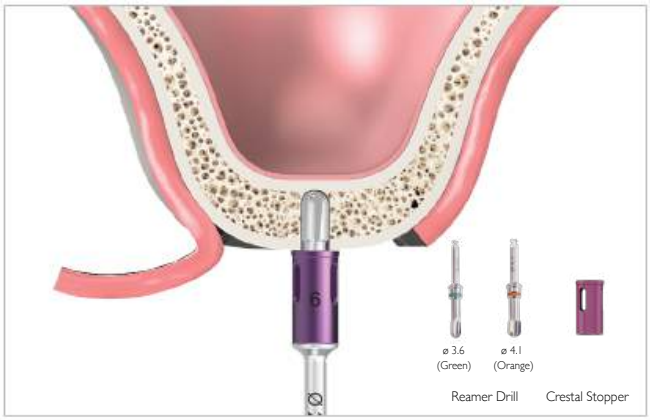

Fig. 5. Connected crestal stopper to SD reamer increase width of the bone removal site

After that, the sinus can be lifted by two methods, namely the "bone packing and spreading" and the "hydrostatic sinus elevation" methods.

First, let me introduce the bone packing and spreading method. From this point on, you should use the sinus bone packer (Fig. 6). The sinus bone packer consists of a ø2.5 mm packer at one end and a ø3.5 mm packer at the other end. Let's assume that the cortical bone in the lower margin of the sinus opens up at 6 mm. Place the bone graft material at the preparation site using a small surgical curette (Fig. 7), fit a 6 mm stopper into the ø3.5 mm packer, and carefully push the bone graft material into the drill preparation site. Using the ø2.5 mm bone packer fitted with a 1 mm long stopper, spread the bone graft material in a lateral direction, while rotating it in a circular motion along the side wall at the preparation site (Fig. 8). After placing the bone graft material, again by using a ø3.5 mm bone packer fitted with a 6 mm stopper, which is the length when the lower margin of the sinus opens up. Then proceed with bone packing using a ø2.5mm bone packer fitted with a 7 mm stopper, while spreading the bone graft material in a circular motion along the side wall of the preparation site. Repeat this method 5 to 6 times to allow the elevation of the sinus mucosa by about 4 to 5 mm vertically, while minimizing the risk of perforation of the sinus mucosa (Fig. 9). Then, pack the bone graft material using the ø3.5 mm bone packer fitted with a 7 mm stopper and spreading laterally using the ø2.5 mm bone packer fitted with an 8 mm stopper, while increasing the length, progressively, up to 10 mm. Finally, depending on the bone quality, additional drilling is performed to obtain implant fixation, and placement of the implant (Fig. 10). This is the method which I developed, in order to lift the sinus mucosa more stably and predictably by packing the bone graft material in a horizontal direction. I came up with this method after suffering from frequent perforation of the sinus mucosa when using the conventional bone packing and spreading method of packing bone graft material in a direction perpendicular into the sinus floor.

Fig. 6. Sinus Bone packer

Fig. 7. Place the bone graft material at the preparation site using a small surgical curette

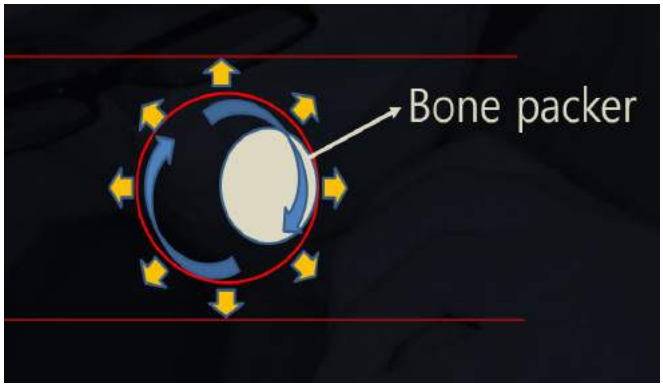

Fig. 8. Rotating it in a circular motion along the side wall at the preparation site

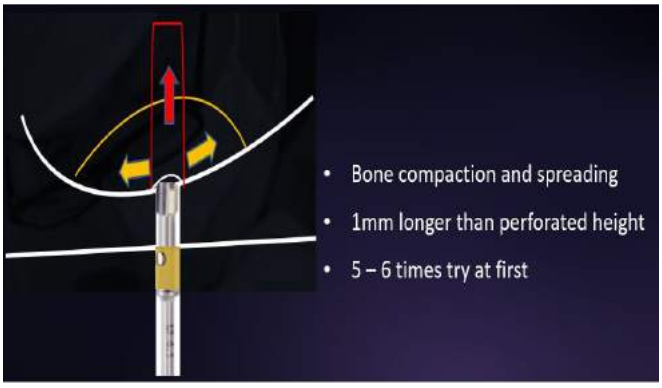

Fig. 9. Horizontal force(yellow arrow) is more useful to minimize sinus membrane perforation than vertical force(red arrow)

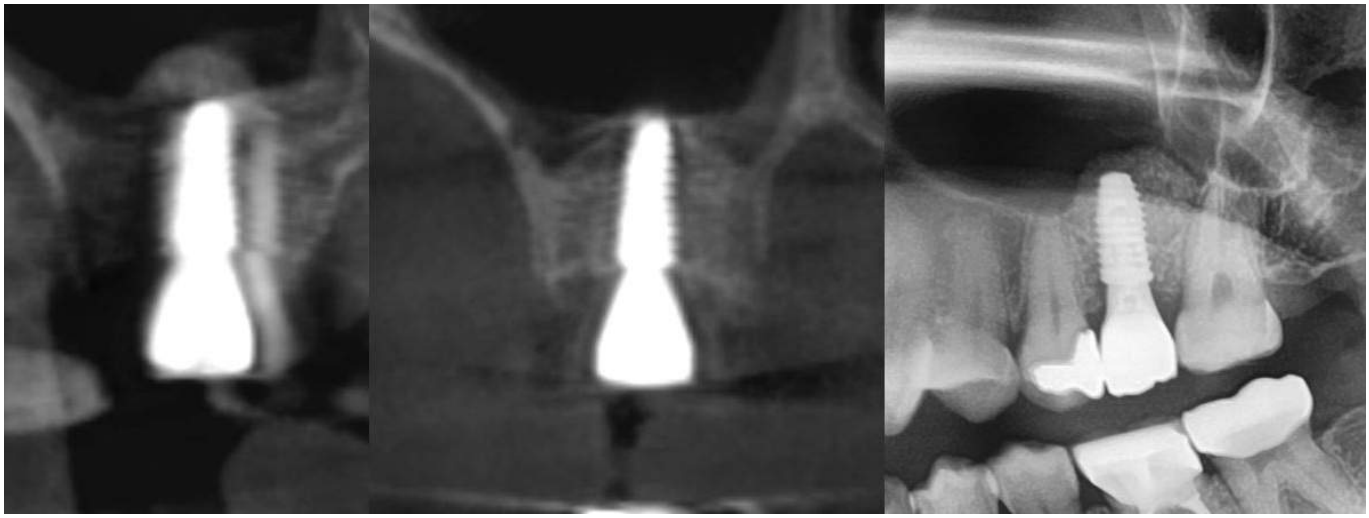

Fig. 10. Depending on the bone quality, additional drilling is performed to obtain implant fixation, and placement of the implant

Next, we turn our focus to hydrostatic sinus elevation. Clinicians who are first introduced to the bone packing and spreading method, may find this a bit complicated to understand and learn. However, the hydrostatic sinus elevation method is actually very simple and intuitive. The procedure, up to the step of opening up the lower edge of the sinus, is the same as the bone packing and spreading method. Then, use the aqua tip at the preparation site, gently push in the physiological saline solution with an additional syringe to lift the sinus floor by water pressure (fig. 11). During the hydrostatic sinus elevation, the syringe is connected to the aqua tip attached to the preparation site. If blood is sucked up, as indicated by the yellow arrow in (Fig. 11), when aspirating the syringe, it is evidence that there is no mucosal perforation. Any rise of air bubbles is evidence of mucosal perforation, or poor connection between the aqua tip and the preparation site. Sinus floor elevation by water pressure seems to be the safest way to lift the sinus mucosa without perforating it. However, when a large amount of sinus mucosa needs to be lifted via the crestal approach, it is often difficult to accurately predict the amount of sinus mucosa elevation according to the amount of saline injected. Since the viscosity and elasticity of the sinus mucosa varies from patient to patient, an unexpectedly large amount of mucosa may be lifted with a small amount of saline in some patients. This may result in an iatrogenic pseudo-cyst under the overly lifted mucous membrane (Fig. 12).

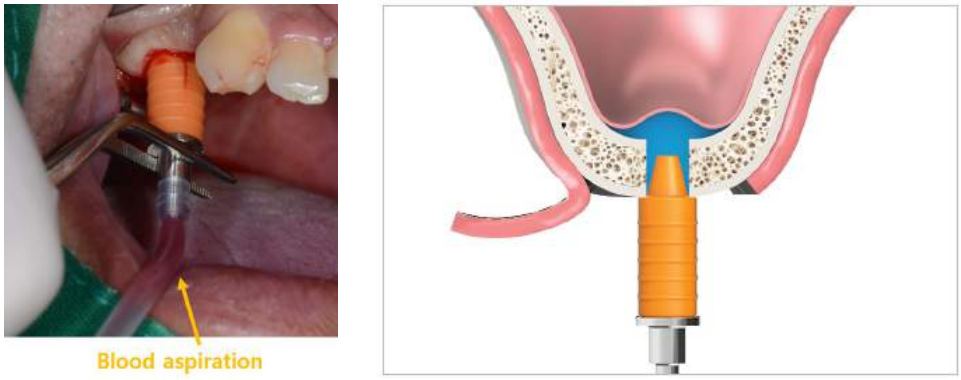

Fig. 11. Use the aqua tip at the preparation site, gently push in the physiological saline solution with an additional syringe to lift the sinus floor by water pressure

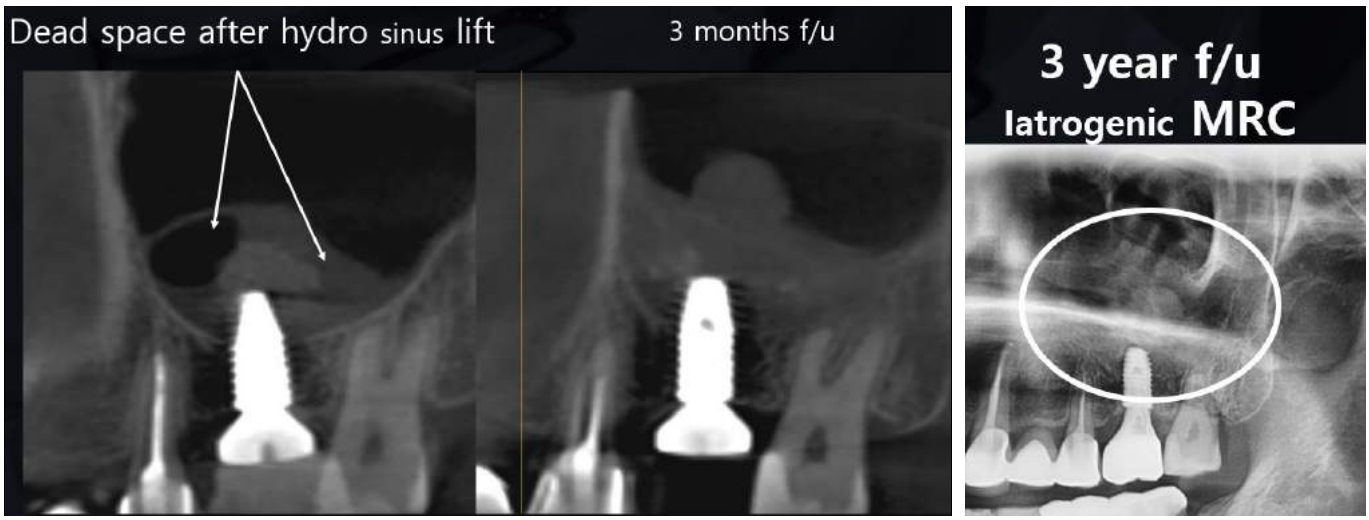

Fig. 12. Result in an iatrogenic pseudo-cyst under the overly lifted mucous membrane

Therefore, for clinicians who have relatively less experience in sinus floor elevation using the crestal approach, I would recommend the simple and intuitive hydrostatic sinus elevation for lifting a small amount of sinus mucosa, about 2 to 3 mm, and the bone spreading and packing method for lifting a larger amount of sinus mucosa. There are many different methods of performing sinus floor elevation, depending on the preference and skills of the operator. Therefore, it is necessary to learn the various methods and find the most suitable method through a lot of experience.

Now, let us look at two cases of sinus floor elevation via the crestal approach using the SAVE SINUS Kit and SQ implant of Dentis.

Case Report

Case 1

The patient was a 52-year-old male with no systemic history, but a long history of smoking. Six months ago, #26 was extracted due to periodontal problems. He came to the hospital for implant prosthesis (Fig. 13a). In the panoramic view, the height of the residual ridge was about 5.6 mm (Fig. 13a), but the height of the ridge seen from the cross-section of the CBCT was about 4.5 mm, which was slightly shorter than that of the panoramic view (Fig. 13b). After initial drilling with a 4 mm stopper (Fig. 13c), the 5 mm stopper was fitted to the SD reamer, the cortical bone in the lower margin of the sinus was opened up, and the sinus mucosa was lifted using the bone spreading and packing method as described above. After final drilling (Fig. 13d), the Dentis SQ 5.5 x 10 mm fixture was placed (Fig. 13e). The healing abutment was connected by one stage (Fig. 13f), and the prosthesis was completed after three months of osseointegration (Fig. 13g). The panoramic views immediately after implant placement and in the two year follow-up show the stably lifted sinus mucosa and smooth remodeling of the transplanted allogeneic bone (Fig. 13h and 13i).

Fig. 13a. Pre-OP panorama x-ray

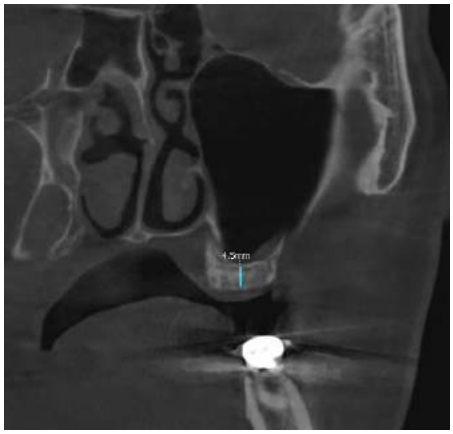

Fig. 13b. Pre-OP CT

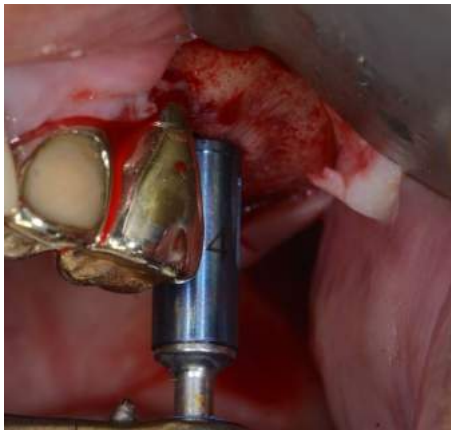

Fig. 13c. 4 mm stopper was connected with reamer drills and enlarged The hole

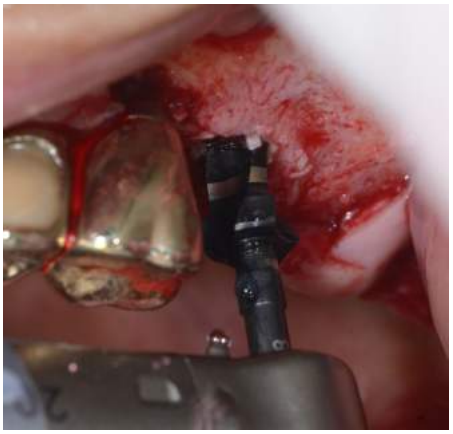

Fig. 13d. Final drilling

Fig. 13e. # 27 SQ Ø5.5x10mm implant was placed

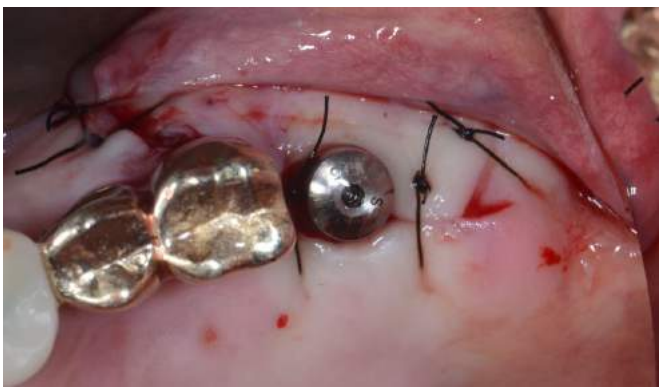

Fig. 13f. Suture was done after healing abutment was connected

Fig. 13g. Custom abutment and Final prosthesis (Zir crown) was delivered

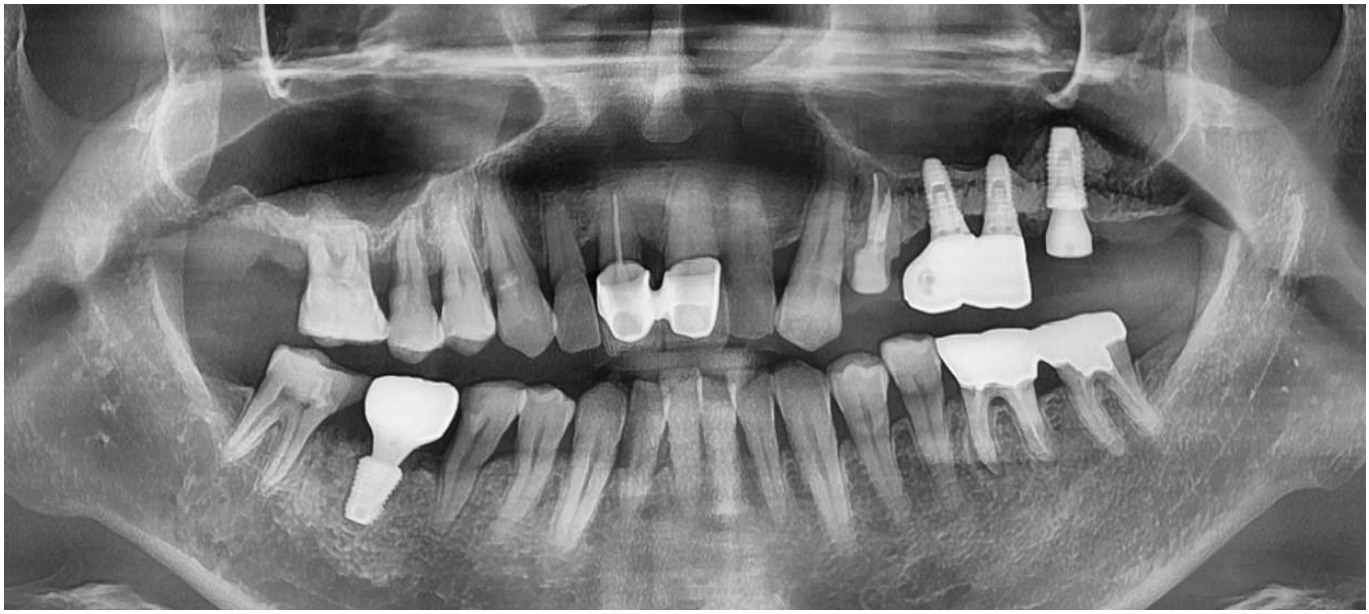

Fig. 13h. Post-OP panorama x-ray

Fig. 13i. Post-op 2 years follow up panorama x-ray

Case 2

The patient was a 67-year-old female with a systemic history of severe rheumatic disease and no history of smoking. She came to the hospital with severe mobility of the incisors and the right molar and pus coming out (Fig. 14a-1,2).

The height of the ridges seen from the cross-section of the CBCT was 3.7 mm for #16 and 3.2 mm for #26 (Fig. 14b and 14c).

Simultaneous sinus floor elevation was performed at areas #15, 16, and 26. After initial drilling with a 3 mm stopper, the 4 mm stopper was fitted to the SD reamer, the cortical bone in the lower margin of the sinus was opened up, and the sinus mucosa was lifted using the bone spreading and packing method as described above. After sufficiently lifting the sinus mucosa, the elevation of the mucosa was confirmed carefully with the depth gauge fitted with a 10 mm stopper (Fig. 14d). Then, the Dentis SQ implants were simultaneously placed at the #15, 16, and 26 sites (Fig. 14h). The prostheses were completed after three months of osseointegration (Fig. 14i and 14j). The two year follow-up panoramic view shows the stably lifted sinus mucosa and smooth remodeling of the transplanted allogeneic bone (Fig. 14k).

Fig. 14a-1. Pre-OP clinical front view

Fig. 14a-2. Pre-OP panorama x-ray

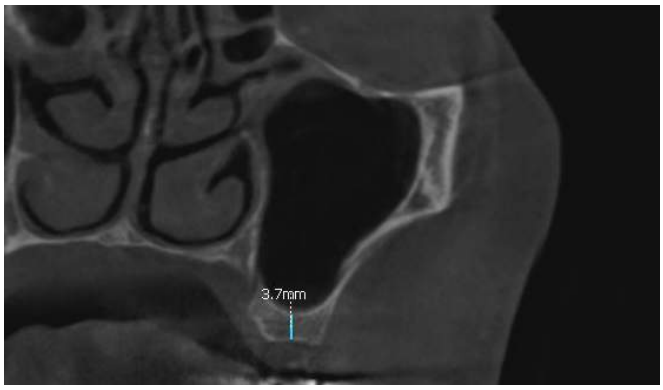

Fig. 14b. # 16 Pre- OP CT

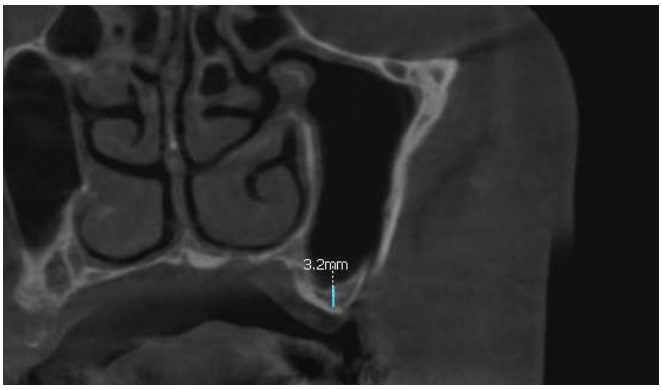

Fig. 14c. #26 Pre-OP CT

Fig. 14d. #15 After drilling, depth gauge was used being connected with crestal stopper to check sinus floor penetration

Fig. 14f. One-Q Ø5.2x10mm implant was placed

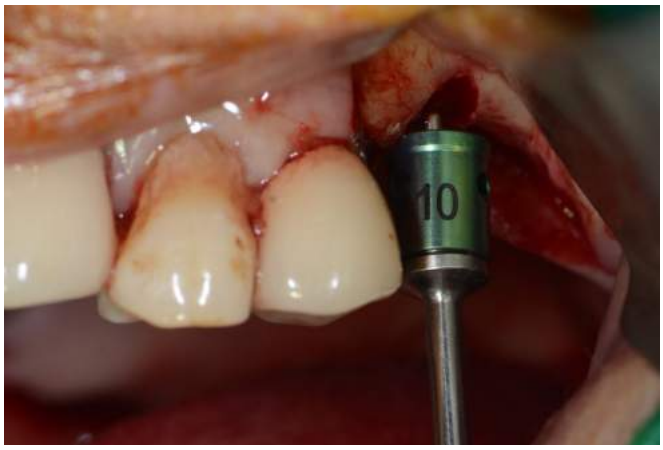

Fig. 14g. #26 Post-op panorama x-ray

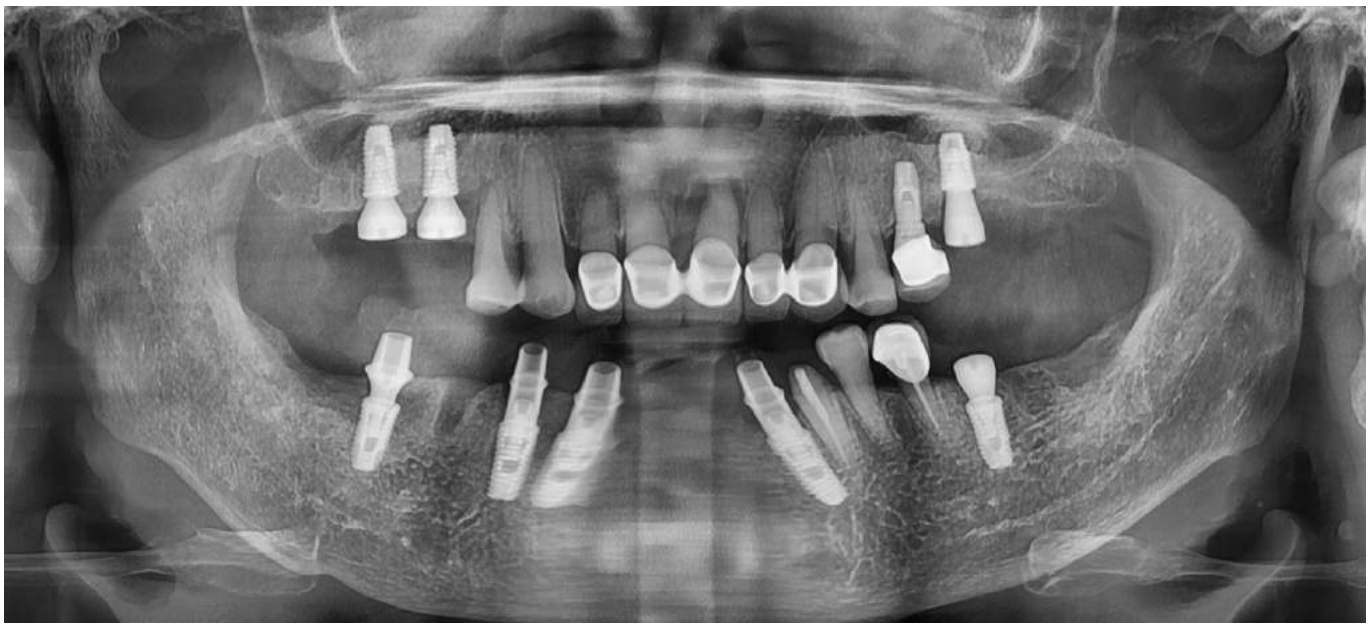

Fig. 14h. # 15, 26 Post-op panorama x-ray

Fig.14i Final prosthesis delivered

Fig.14j-1. Post- OP view(Occlusal)

Fig. 14j-2. Post- OP view (Right)

Fig. 14k. Post-op 2 years follow-up panorama x-ray

Conclusion

We have looked at various methods of sinus floor elevation using the crestal approach. While hydrostatic sinus elevation allows easy and safe lifting of the sinus mucosa, it may be difficult to accurately predict the amount of elevation. Therefore, it is recommended that this method be used when a small amount of elevation is required. The bone packing and spreading method may take more time to perform and it is a more difficult approach to learn, but it is possible to obtain safer and more predictable results compared to the existing crestal approach method. Therefore, the bone packing and spreading method is recommended for cases requiring large amounts of elevation.

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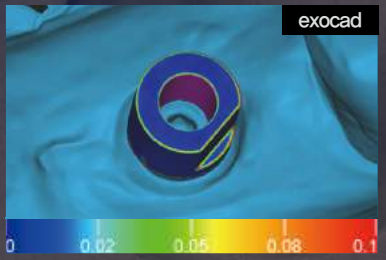

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