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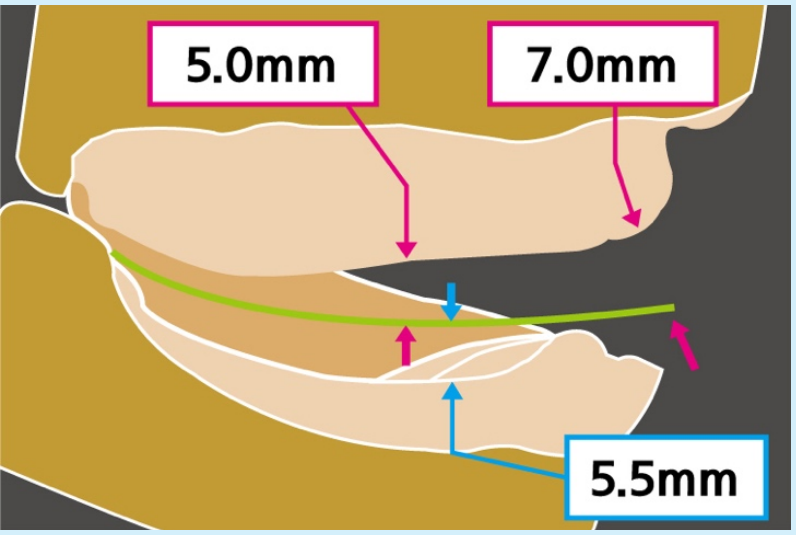
Journal of Clinical & Digital Dentistry



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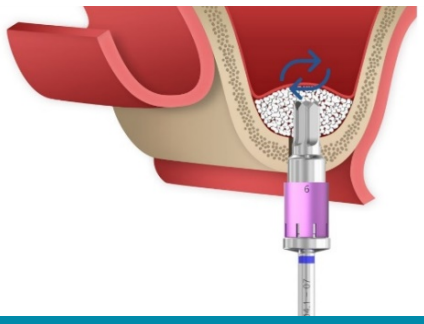

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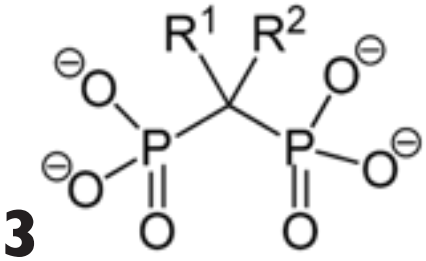

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About the Journal

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

In the mid-1990s, when dental implant treatment began to gain popularity, long-term research on implant surgical procedures and bone grafts were insufficient. At that time, sinus elevation surgery with bone grafting was considered an advanced treatment option. However, with the development of numerous surgical methods and instruments, sinus elevation surgery with implant placement has presently become the most predictable treatment procedure. In addition, there has been tremendous development in prosthodontic procedures and CAD-CAM techniques for implant dentistry.

Currently, there have been extensive discussions and research debating the success and long-term stability in terms of patient factor. This is because of the postoperative complications encountered due to various systemic diseases and intake of various medications; particularly in cases of osteoporosis, where the occurrence of unexpected BRONS has been the most controversial part in recent years.

In this issue of JCDD, the latest information on maxillary sinus elevation and implant surgery using a simple and powerful sinus surgical guide system is made available to the readers. In addition, depending on the inter-alveolar distance, guidelines for various prosthetic options have been proposed for oral rehabilitation using implant-supported prosthesis. This issue of JCDD presents simple, but effective guidelines for the treatment of completely edentulous patients. Furthermore, a summary on precautions, such as implant surgery according to the patient's medication, has been included. This will provide a good reference in daily clinical practice.

In the cold winter, I hope that JCDD will warm patients' hearts through your new knowledge and skills.

Wongun Chang, DDS MS PhD

SQ GUIDE

DENTIS Digital GUIDE System for SQ IMPLANT

Application of Irrigation

Reduce bone heating with innovative irrigation-type drill design

Fixture Placement is Possible with Only Three Drillings

Application of multi-pass drilling makes 2-point fixation possible with increased accuracy due to minimal tolerance

Sleeve with Biocompatible Material

Increased stability with titanium sleeve

Stress Free! Use SQ Implant

DENTIS SQ implant with strong initial fixation

DENTIS

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Use of the Dentis SQ Sinus Guide Kit and Case Reports

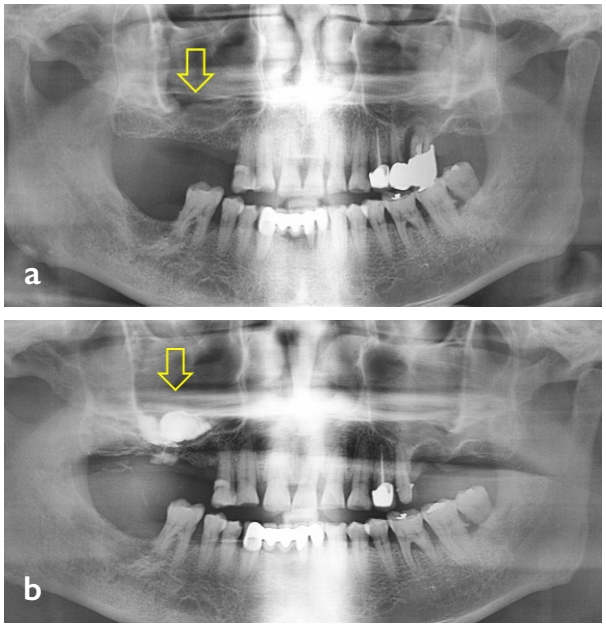
Sangjin Suh, DDS, M.D.

Introduction

Although maxillary sinus elevation is frequently performed for maxillary posterior implant placement, surgical failures such as membrane rupture may occur depending on the complex shape of the sinus' inferior border, the membrane's thickness, the lesion, the degree of membrane adhesion, and the direction of elevation, making the operation difficult and complicated, especially for inexperienced practitioners. Accordingly, recent developments and surgical kits have enabled more precise and safe maxillary sinus elevation through digital guided surgery, which has been well received by clinicians. This study reviews the background and theory for the development of the SQ Sinus Guide Kit, a maxillary sinus guide surgery kit released in September 2021 by Dentis, its differences from other systems, composition, and clinical workflow, and presents relevant case reports.

1. Background and Theory for the Development of the SQ Sinus Guide System

One of the most used methods in maxillary sinus guide surgery is the direct hydraulic elevation method using a high-speed reaming drill. While this method has the advantage of allowing the relatively safe and easy elevation of the maxillary sinus membrane, there is also the disadvantage that the elevation often occurs in an unexpected direction rather than the ideal center dome shape, as the degree or direction of membrane elevation depends on water pressure **(Fig. 1)**.



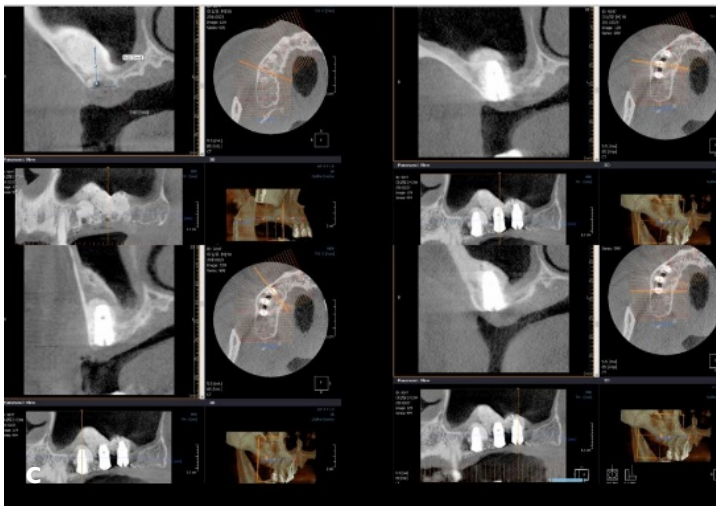


Fig. 1(a-c). A clinical case of maxillary sinus bone graft and implant placement using hydraulic elevation in which the direction of maxillary sinus elevation is slightly biased to one side.

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- Director CEREC Asia trainer and World KOL
- Developer of "SQ guide kit"
- Korean Academy of Digitalized Dentistry - a member of board of directors

This could be caused by membrane adhesion, the gravity of water pressure, lesions(**Fig. 2**), and in particular, the presence of a convex or protruding section in the maxillary sinus floor may increase the possibility of membrane perforation due to the tension concentrated on the site of elevation when sudden pressure is applied. Therefore, in irregular bone shapes such as the septum or sloped floor, it may be difficult to elevate the maxillary sinus floor using hydraulic pressure.

While the membrane should be detached to achieve a uniform dome-shaped sinus elevation from an irregular bone shape to the implant's center, not only is it difficult to manipulate the instrument during a crestal approach, but also there is a high risk of membrane damage in the process **(Fig. 3)**.

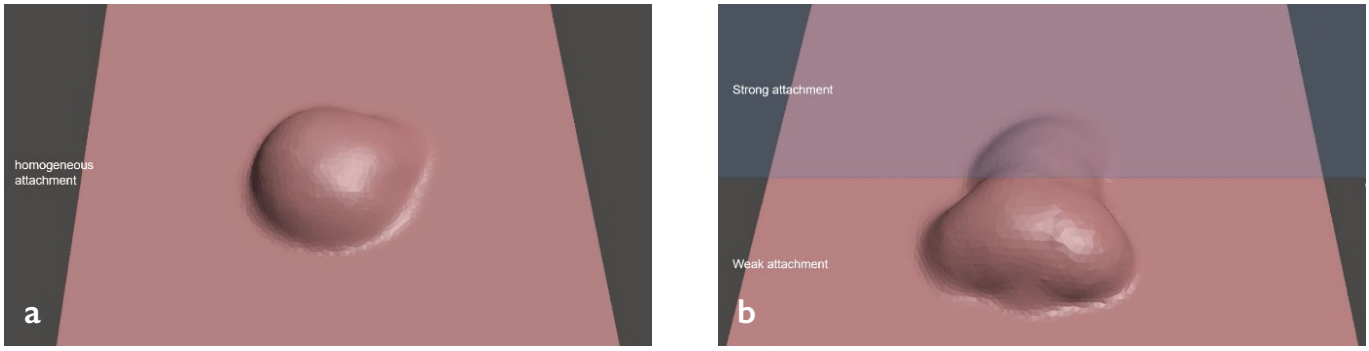


Fig. 2(a-b). If the membrane is homogeneously attached to the maxillary sinus floor, water pressure can be applied uniformly. If it is not homogeneously attached, however, greater pressure is applied in the direction of weak adhesion, resulting in excessive elevation.

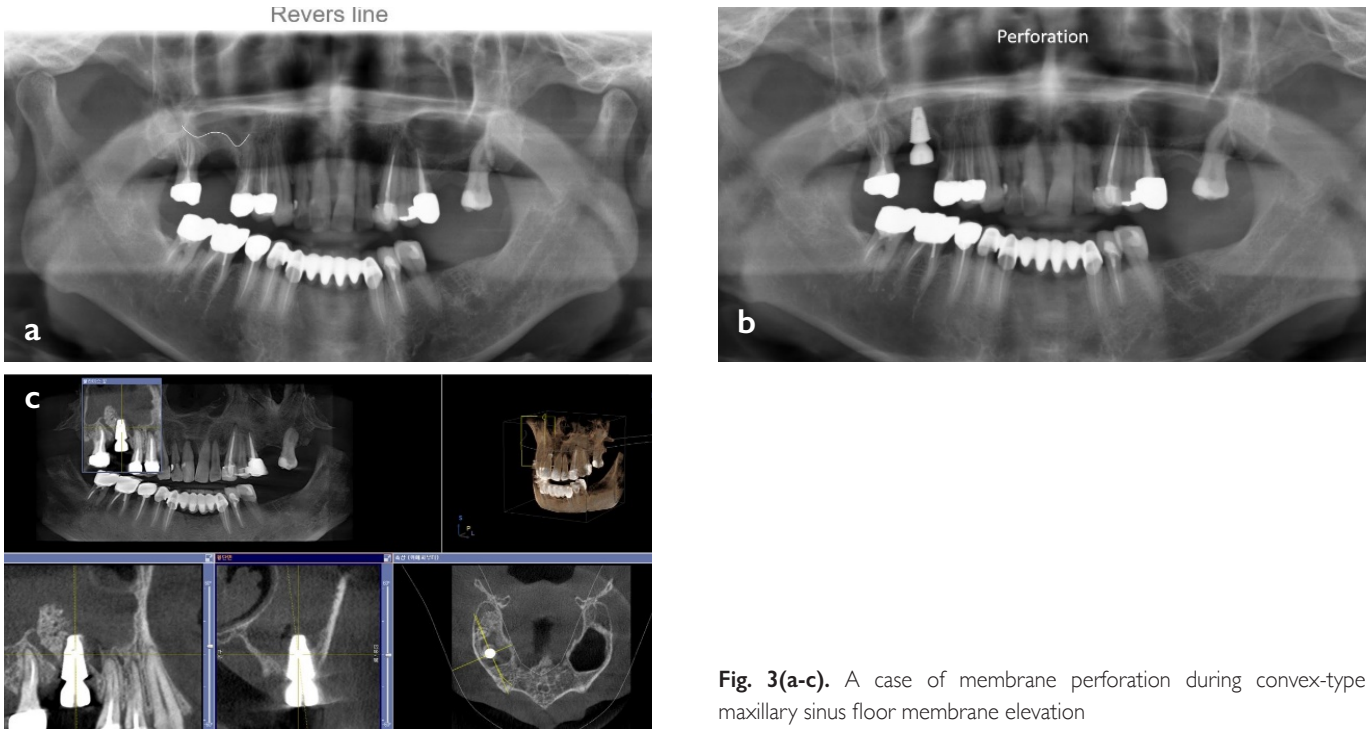


Fig. 3(a-c). A case of membrane perforation during convex-type maxillary sinus floor membrane elevation

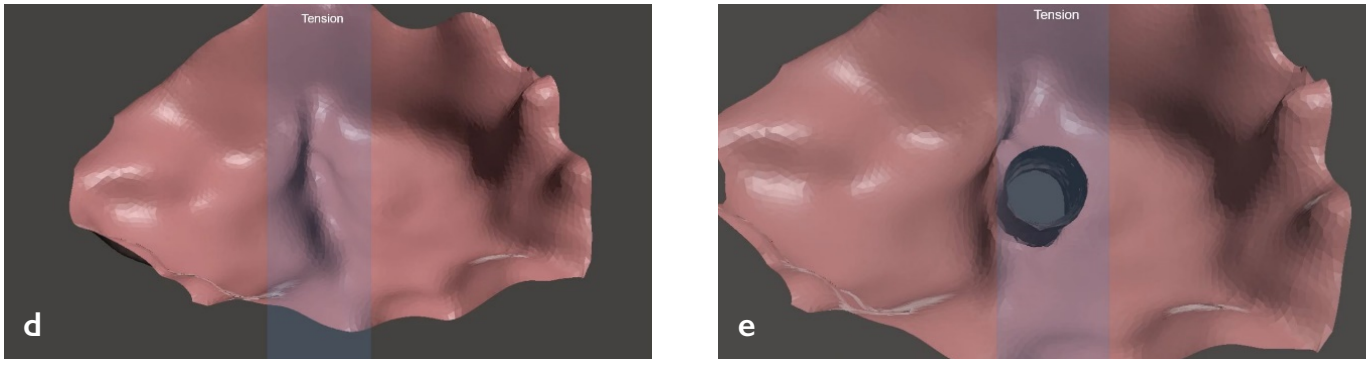
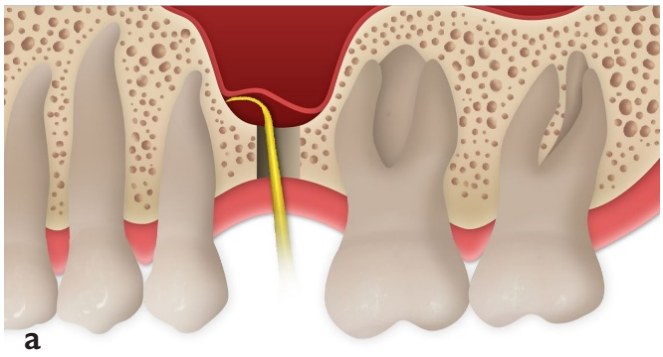
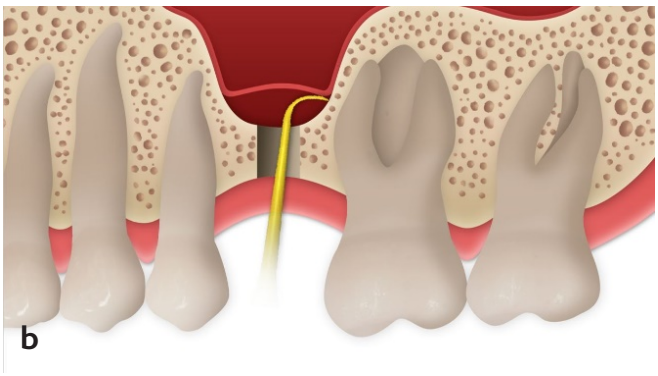


Fig. 3(d-e). The presence of a septum-like protrusion in the maxillary sinus increases the risk of membrane rupture due to increased tension.

For the above reasons, it may be advantageous to separate the membrane using a low-speed reaming drill through bone graft particles rather than using the hydraulic elevation technique or using traditional membrane elevation instruments **(Fig. 4).**





The use of a low-speed reaming drill allows three-dimensional (3D) sinus elevation by simultaneously increasing the diameter and length of the reaming drill even in irregular vertical and horizontal sinusoidal bone shapes **(Fig. 5, 6).**

This low-speed reaming drill method has been commercialized in analog and digital kits such as Hatch Reamer, which has been on the market for over a decade, and recent releases like Densah Bur and HaeNaem Bur.

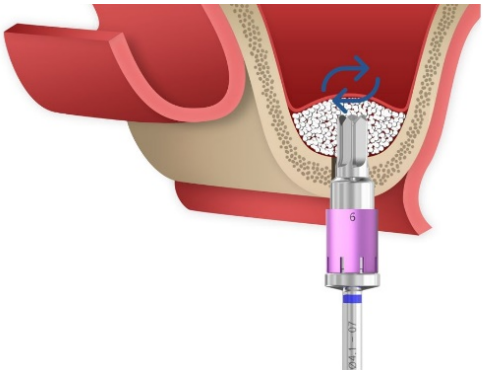
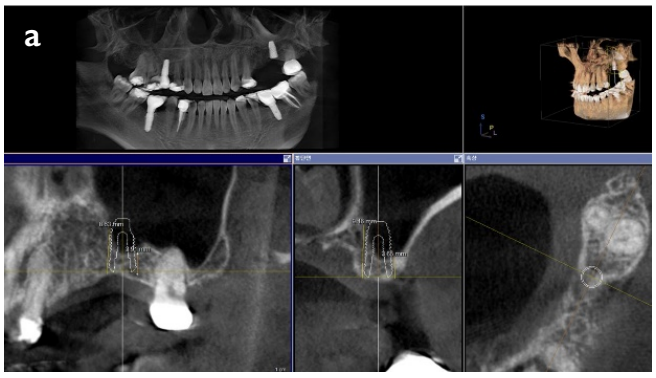
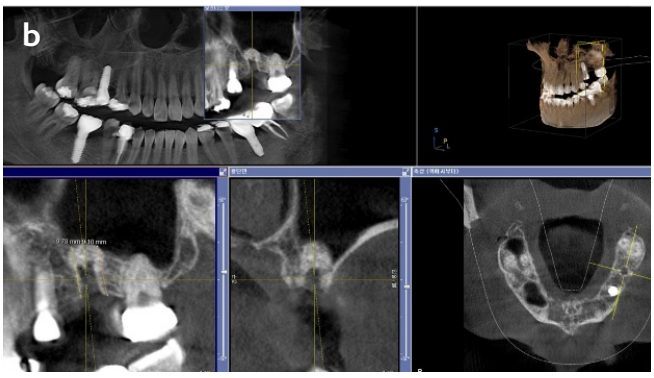


Fig. 4(a-c). Detachment of the maxillary sinus membrane with a sinus elevator and the bone spreading method using graft bone particles.





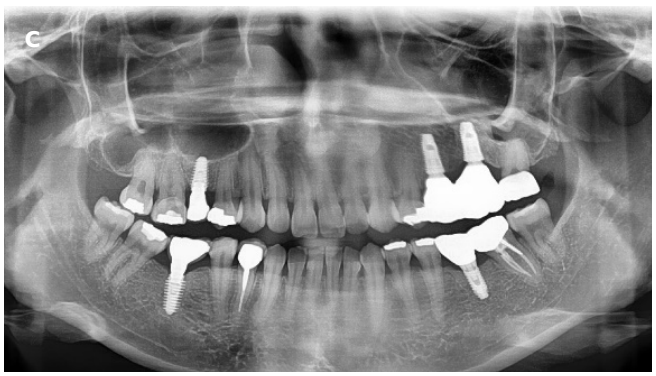


Fig. 5(a-c). Irregular maxillary sinus elevation using the low-speed reaming drilling method.

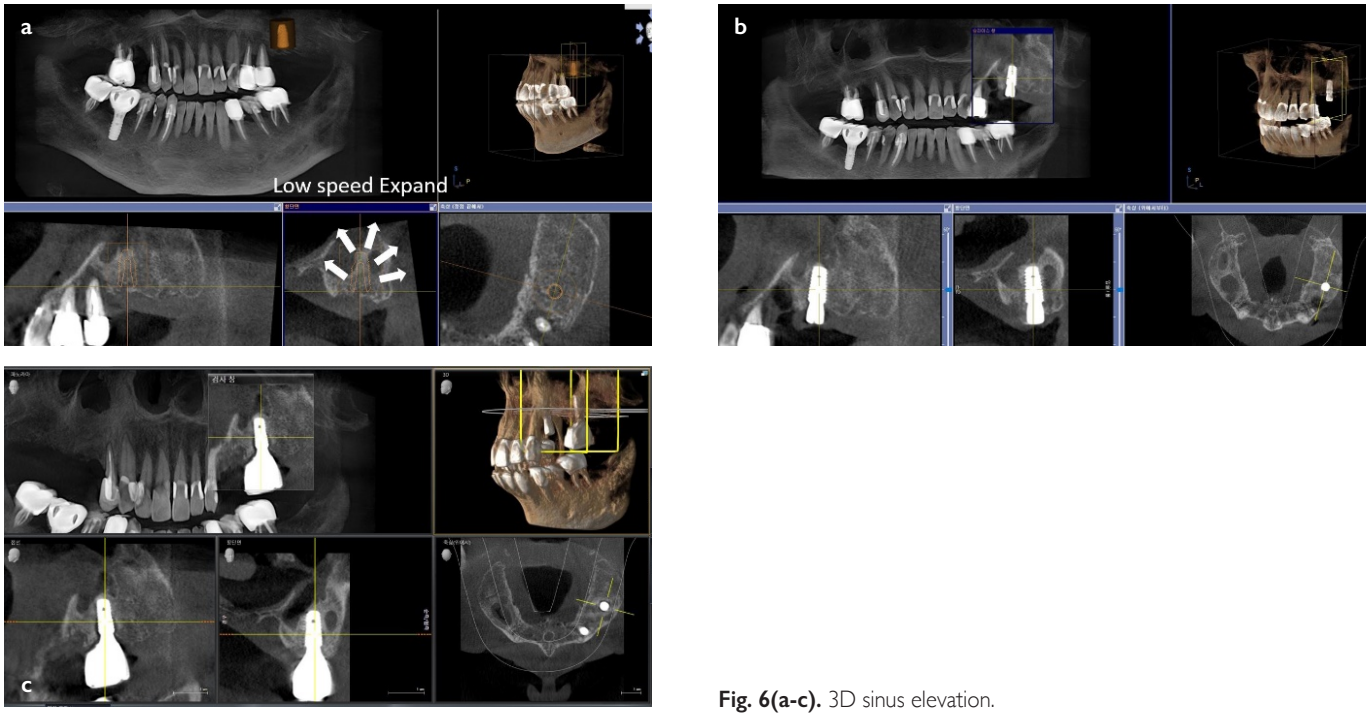


Fig. 6(a-c). 3D sinus elevation.

2. Differentiated Features of the SQ Sinus Guide System

The SQ Sinus Guide Kit is a digital guide drill system exclusively used in the maxillary sinus. It allows for bone grafting and membrane elevation with a central dome measuring about 4 or 5 mm in height. SQ sinus drill does not include a bone condensing function to be faithful to the maxillary sinus elevation function.

Nevertheless, the author and the Dentis development team designed a new drill blade to improve poor cutting efficiency, a disadvantage of the existing low-speed reaming drill. The inclined surface of the reverse drilling blade was blunted to minimize risk of membrane perforation during reverse drilling to spread bone graft materials.

During a hydraulic elevation procedure, it is necessary to attach and detach the guide several times to install a hydro-tip and implant fixture after high-speed drilling. Using the SQ Sinus Guide System, the procedure can be completed without the need for attachment or detachment until implant placement **(Fig. 7).**

Practitioners use guide design software to plan implant placement and determine the type of sinus guide drill required for maxillary sinus elevation. The SQ Sinus Guide Kit is compatible with domestic and foreign software, including Implant Studio (3Shape) and Dentiq (3DII). Furthermore, the SQ Sinus Guide Kit incorporated the components of the existing guide system by Dentis, the SQ Guide Kit, to reduce the overlapping components and lower the cost burden to users

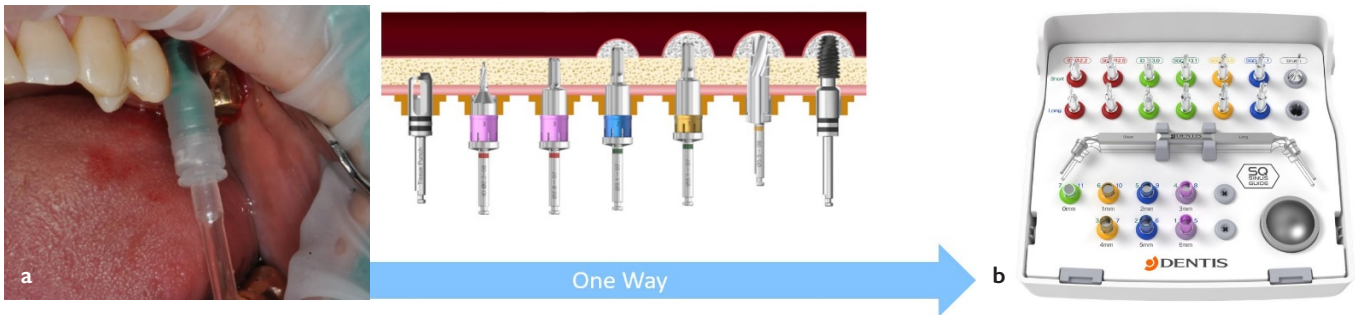


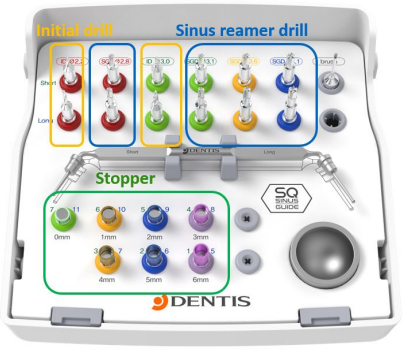
Fig. 7(a-b). **(a)** In the existing hydraulic elevation method, it is necessary to attach a hydro tip and detach the guide stent for bone grafting and implant placement. The SQ Sinus Guide allows an uninterrupted procedure with the guide installed.
(b) SQ Sinus Guide Kit.

3. Configuration and Features of SQ Sinus Guide Drill

The SQ Sinus Guide Kit is composed of 1) a Lindemann initial drill, 2) a sinus reamer drill, 3) a stopper, 4) a bone brush and bowl, and 5) a sinus gauge **(Fig. 8a).**

The high-speed initial drill removes bone within a range that does not invade the maxillary sinus membrane (usually, a safe distance of 0.5–1 mm from the maxillary sinus floor is ensured) This pilot hole guides the maxillary sinus reamer drill.

In the SQ Sinus Guide Kit, the initial drill is configured as a Lindemann drill to increase the removal force. **(Fig. 8b-c).**



a

Fig. 8(a). Drill configuration of the SQ Sinus Guide Kit.

b

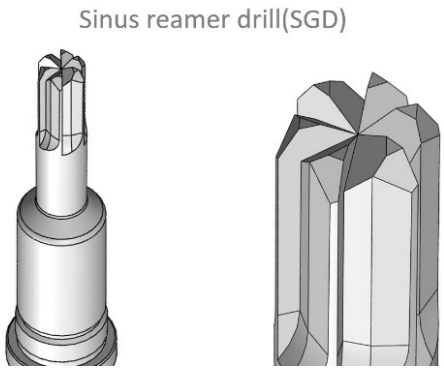
c

Fig. 8(b-c). The initial drill is configured as a Lindemann drill to increase its cutting force, enable active drilling regardless of bone quality, and reduce the number of drills required.

The maxillary sinus reamer blades are designed to increase the bone removal force and minimize membrane damage during elevation and bone grafting. Clinical testing allows for adjustment of the angle and depth of the drill bit to improve bone removal efficiency to the maximum, within the limit. As with other low-speed drilling systems, bone chips laminate in the groove of the drill after bone removal and minimize damage to the maxillary sinus membrane. **(Fig. 9a-b)**

The NiTi-Hand brush enables the operator to increase the drill's cutting power during bone removal by brushing off the embedded bone chips **(Fig. 9c-d)**. Reverse blade slopes are increased so that when the reamer drill is rotated in the reverse direction, the drill tip can sufficiently spread the bone graft particles without stimulating the maxillary sinus mucosa.

a



b

Fig. 9(a-b). The sinus reamer drill is designed to drill at a low speed of 30–50 rpm. It performs bone removal in the forward direction and bone graft spreading in the reverse direction without any removal force.

Fig. 9(c-d). Bone chips embedded in the groove of the sinus reamer drill can be easily removed by using the NiTi-Hand brush, which increases the cutting force of the low-speed drill.

The initial and maxillary sinus reamer drills are short and long, respectively, and are used to conserve 1–11 mm of bone in the maxillary sinus (3–4 mm of residual bone is recommended for a crestal approach). The initial drill is 1 mm shorter than the sinus reamer drill when using the same stopper **(Fig. 10)**.

The SQ Sinus Guide System can be used in both flap and flapless surgery, without needing to remove the guide for bone graft and implant placement during flapless surgery. The bone graft material can be hydrated in the bone bowl and transported with the bone carrier into the guide's titanium sleeve, or syringe-type bone graft material can be hydrated and inserted directly **(Fig. 11)**.

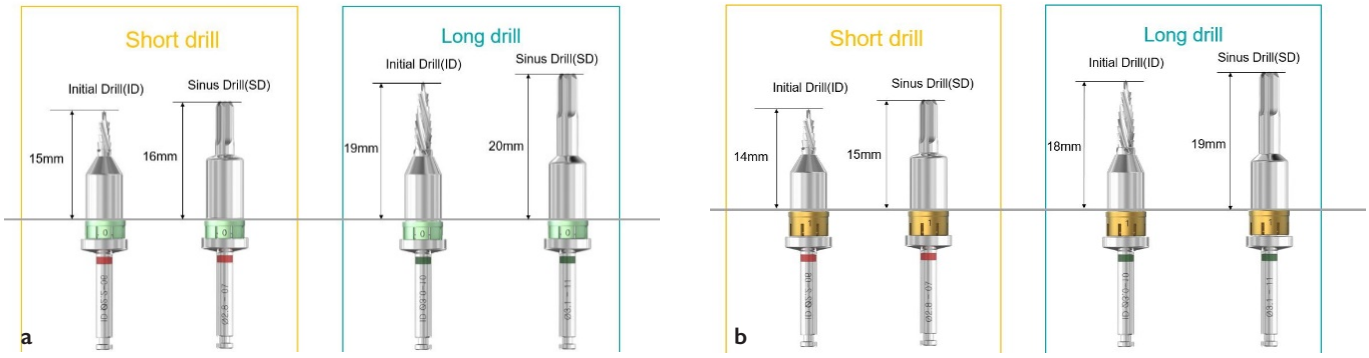


Fig. 10(a-b). As with the 0-mm stopper, the sinus reamer drill has a total length of 16 mm for short drills and 20 mm for long drills. Each initial drill is 1 mm shorter, and each time the stopper is lengthened by 1 mm, the drill is shortened by 1 mm. Maxillary sinus elevation involves first reaching the sinus' inferior border with the sinus reamer drill, and sinus membrane elevation and bone grafting are then performed while advancing using a 1-mm long sinus reamer drill.

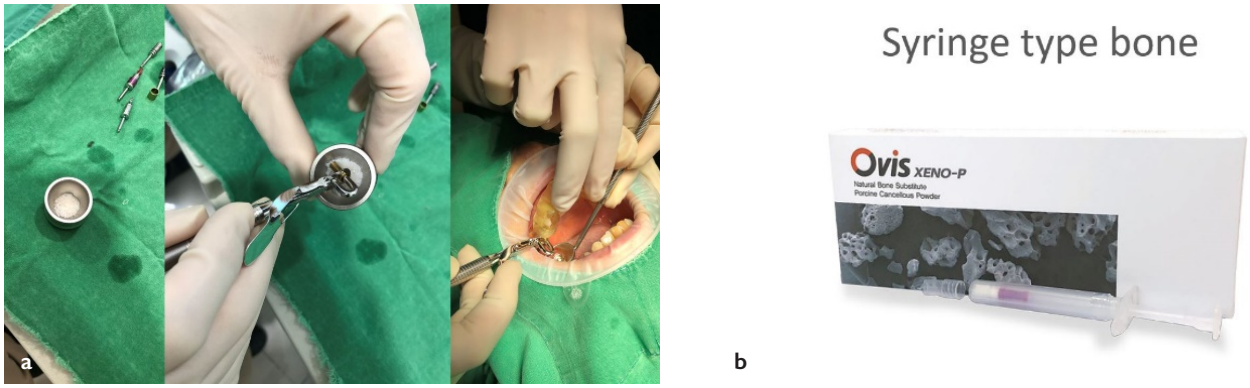


Fig. 11(a-b). Since the SQ Guide System features a titanium sleeve, bone graft material can be safely injected into the sinus membrane through the sleeve.

The composition of the SQ Sinus Guide Kit has been minimized by allowing the soft tissue punch, bone flattener, final drill, and fixture mounter driver to be shared with the existing SQ Guide Drill Kit **(Fig. 12a).**

Since the cutting power of the SQ Sinus Guide Kit's Lindemann initial drill was excellent, the Ø2.2 initial drill of the existing SQ guide drill was similarly configured.The increased cutting force of the initial drill minimizes bone quality and enables stable initial drilling.Therefore, this configuration is strongly recommended for existing SQ Guide Kit users **(Fig. 12b).**

a

b

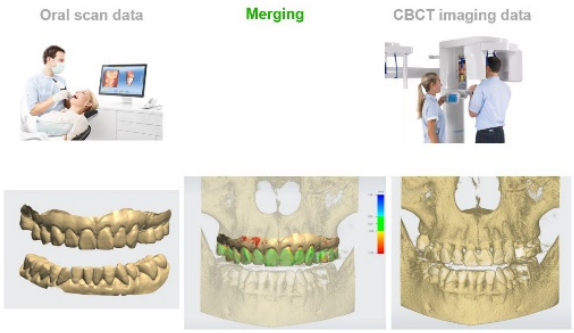
Fig. 12(a-b). (a) SQ Guide Kit
(b) SQ Guide Ø2.2 Lindemann Drill

4. Clinical workflow of the SQ Sinus Guide Kit

As with the general production of a guide for implant surgery, the SQ Sinus Guide production process involves 1) the acquisition of the patient's oral or model scan data (STL file format) and cone-beam computed tomography (CBCT) DICOM file extraction, 2) implant planning and guide design, 3) 3D printing the guide, and 4) guided implant surgery.

If the clinic has an oral scanner, the patient's STL file can be directly transferred to the implant guide software. Otherwise, a plaster model poured from an oral impression can be sent to a laboratory or implant design center to be scanned and converted to an STL file.

The presence of many dental prostheses during a CBCT scan creates challenges when accurately superimposing the STL and DICOM files due to the diffused reflection caused by metal artifacts. Accurate merging is possible only when there are three or more natural teeth in the maxillary arch with the aid of a resin marker. In edentulous jaws, merging can be performed using a resin marker on the attached gingiva or dentures. For accurate guided surgery, there should be minimal distortion and merging error in the STL and the DICOM files **(Fig. 13).**



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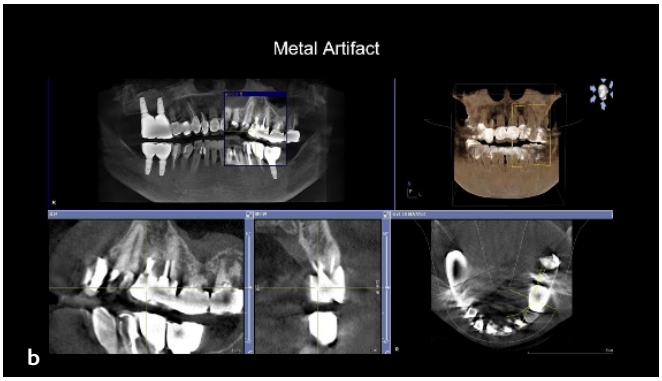


b

Fig. 13(a-b). (a) After merging the oral scan data and CBCT imaging data, an inspection can be performed in Implant Software Studio.
(b) Metal artifacts caused by dental prostheses.

Implant planning and guide design require dedicated software that allows guides to be designed in the clinic. Generally, a confirmation is received from the client after implant planning at the guide design center. Among domestic implant design centers, Implant Studio (3Shape) is the most widely used; Dentiq (3DII) and Exoplan (Exocad) are also used. The CEREC Guide by Dentsply Sirona has dedicated software for chair-side guides milled in-house.

When purchasing the guide software, consider its compatibility with the intended guide drill system, its precision of superimposition, the possibility of making a preoperative prosthesis, and the fee structure, often per case or subscription based.

Guides were previously produced using an SLA- or DLP -type 3D printer, but recently, a relatively inexpensive LCD -type 3D printer has also become popular. Resin materials officially approved by the Ministry of Food and Drug Safety should be used for printing guides. Since printing guides does not require as fine precision as that required for the prosthesis, deposition of 50–100 μm along the Z-axis would suffice for guide laying.

When performing guided surgery, the tolerance between the sleeve and the guide drill must be considered. Depending on the guide drill system, various tolerances range from 50-150 μm, leading to a distortion of the drill tip's position depending on the drilling direction. If the lower bone has irregular quality, it is recommended to drill sufficiently in the center direction until you feel passive for accurate drilling

The SQ Sinus Guide System's manufacturing process is similar to a conventional implant guide, but there is a difference in implant planning. The SQ Sinus Guide Drill's method is presented below, along with a walkthrough of planning in an actual clinical case using the Implant Studio software **(Fig. 14).**

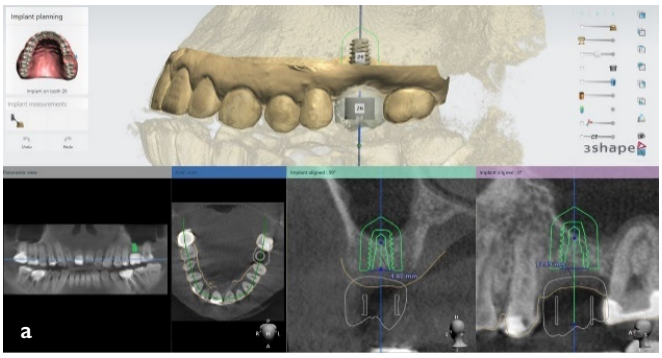


Fig. 14(a). After superimposing the oral scan data with the CBCT file in the Implant Studio, the tooth can be designed virtually, and the implant location can be determined based on this design. After planning the #26 implant, the fixture's position is shown to be invading the maxillary sinus. The shape of the maxillary sinus is inclined downward distally.

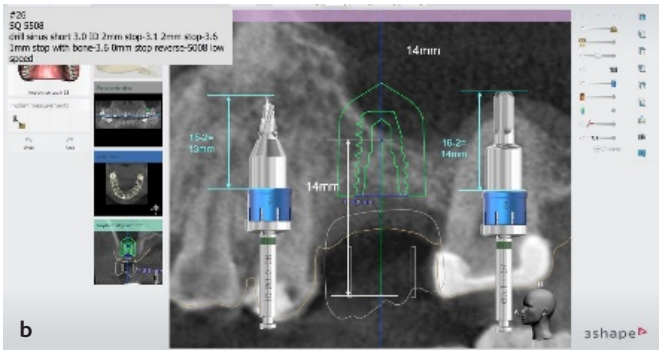


Fig. 14(b-d). Since the distance measured from the top of the sleeve to the sinus' inferior border is about 14 mm, 13 mm Ø3.0 Lindemann initial drill was selected for safety (1 mm short of the inferior border). As the drill's total length is 15 mm with a short drill 0 mm stopper, a 2 mm stopper can be used. Next, a Ø3.1 sinus reamer drill with a total length of 14 mm can be selected to reach the sinus' inferior border.

As the sinus reamer drill is set to be 1 mm longer than the initial drill, a 2-mm stopper can be used. The Lindemann initial drill can be used at high-speed with irrigation, and the sinus reamer drill at low speed without irrigation. The membrane of the sinus' inferior border was partially exposed with a Ø3.1 sinus drill, but the anterior part of the slope is not yet accessible, requiring an additional long drill to elevate the membrane

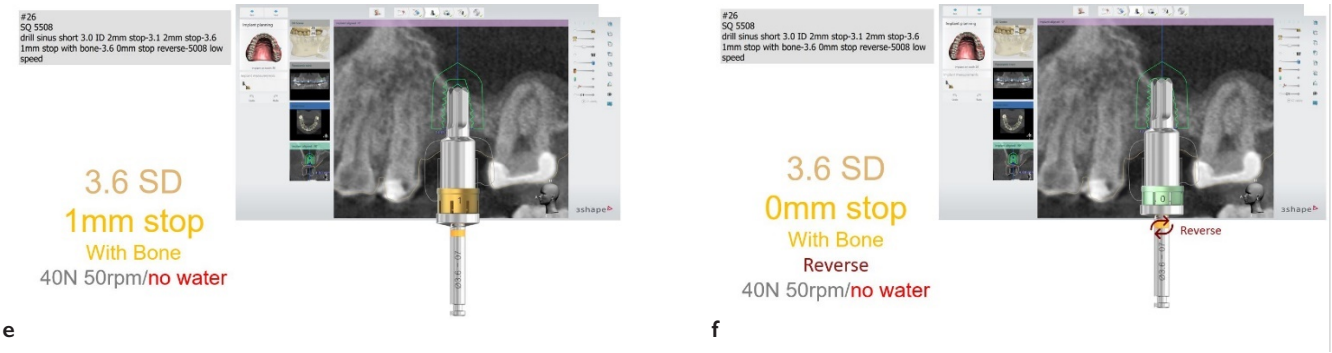


Fig. 14(e-f). (e) Since some membranes were exposed, graft bone particles were added for membrane elevation and safe additional drilling, and low-speed drilling is performed with a ø 3.6 maxillary sinus reamer drill with a wider diameter and a 1 mm stopper. The membrane of the sinus' inferior border on the inclined mesial side is not yet detached, and additional work with the instrument is required.

(f) Additional membrane detachment and elevation can be expected through bone spreading using a 0 mm stopper sinus drill. The membrane damage caused by the drill can be minimized by rotating the maxillary sinus drill in the reverse direction, and bone spreading can be enhanced using a gently inclined blade.

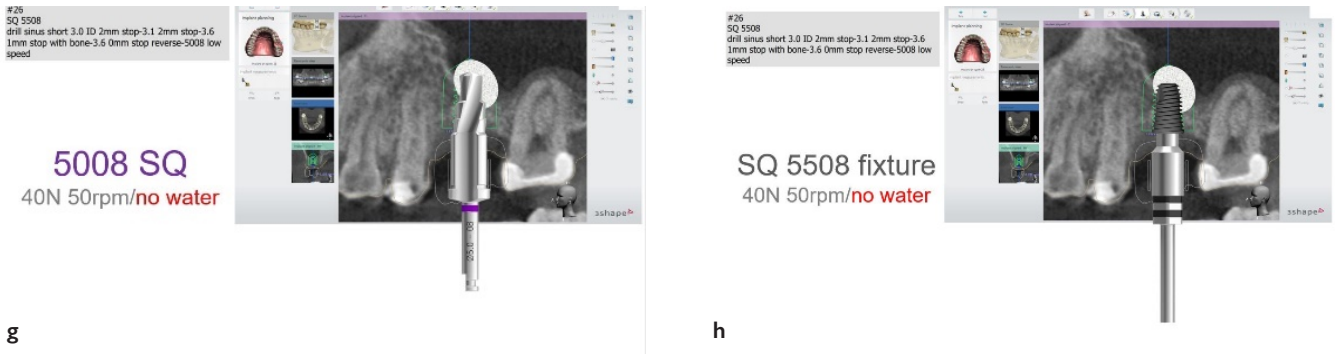


Fig. 14(g-h). The final drill and fixture mounting driver from the SQ Guide Kit can be used. Since the bone quality is poor, the implant is placed after low-speed drilling with a final drill with a lower diameter for initial fixation (SQ Fixture 5.5 ×8 mm; Dentis)

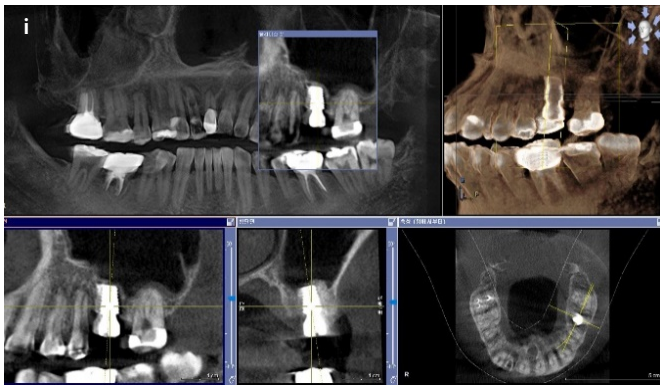


Fig. 14(i). Postoperative CBCT images.

Case Report

Case 1

This is a case of maxillary sinus elevation with a concave shape of the maxillary sinus floor and about 3 mm of residual bone. **(Fig. 15).**

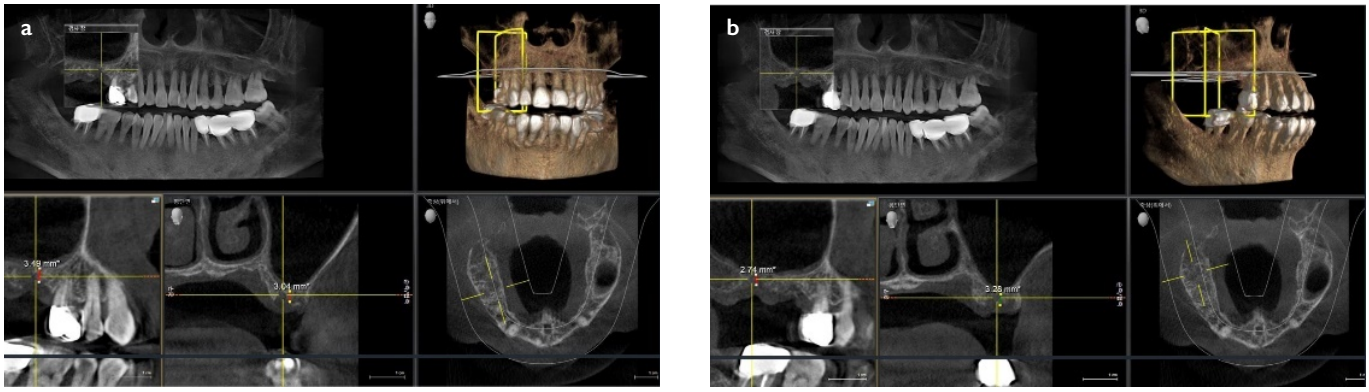


Fig. 15(a-b). Implants #16 and #17 required placement, and the height of the remaining bone was about 3 mm.

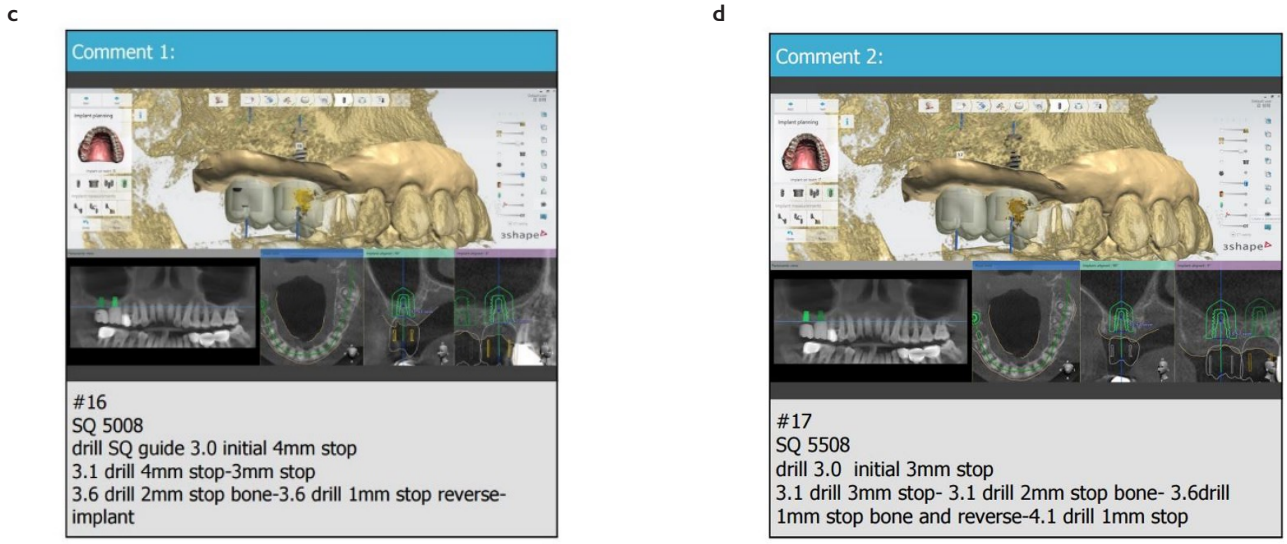


Fig. 15(c-d). The photos of maxillary sinus elevation drilling and planning for implants #16 and #17 are shown. Initial drilling with a drill 1 mm shorter than the sinus' inferior border and spreading the bone graft material by advancing the sinus drill 1 mm at a low speed to elevate the maxillary sinus membrane was planned.

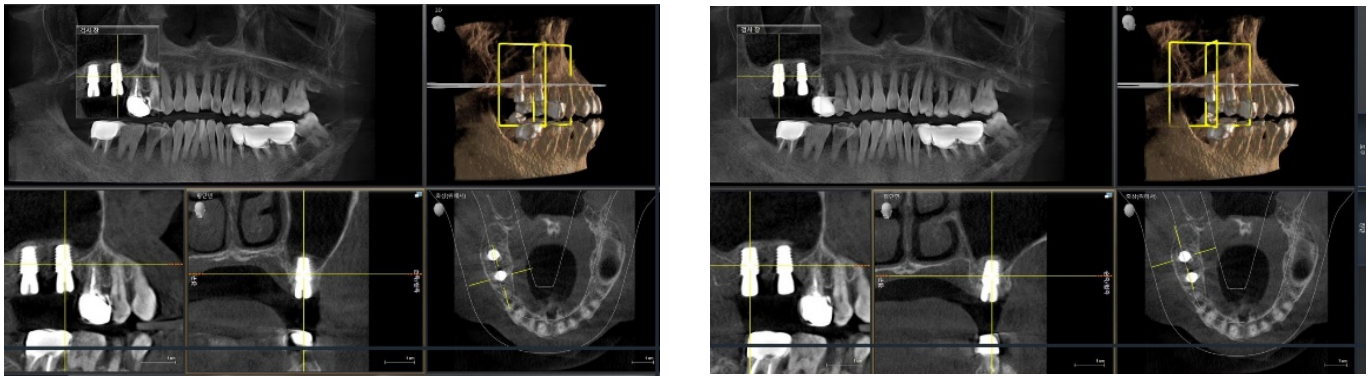
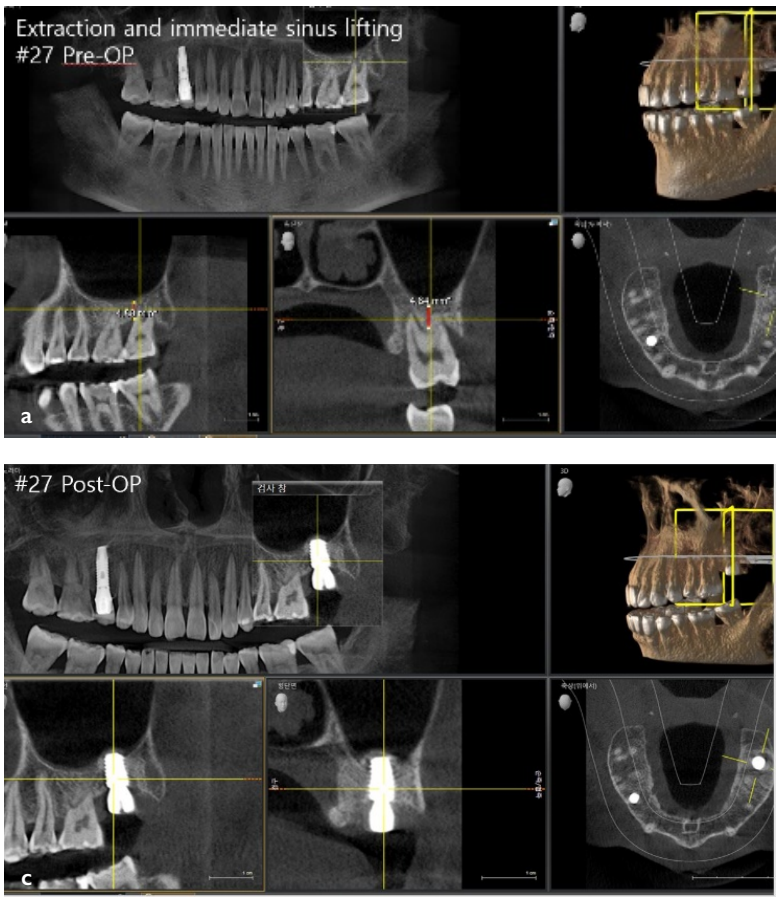


Fig. 15(e-f). Postoperative CBCT images. The 8-mm long implants were placed in the #16 and #17 regions, and maxillary sinus elevation and bone grafting were performed around the implants in a dome shape.

Case 2

This was a case of immediate implant placement and maxillary sinus elevation following the extraction of #27 in the maxillary region **(Fig. 16).**



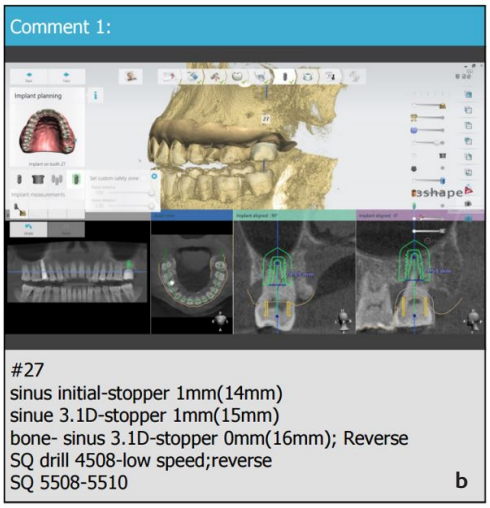


Fig. 16(a-c). (a) Postoperative CBCT images. As the residual bone's height was 4.8 mm with no extensive bone destruction, we planned to place the implant immediately after tooth extraction. In guided surgery, it is relatively easy to obtain sufficient implant fixation force for implant placement immediately after tooth extraction compared to the conventional method, as it is possible to drill with a certain degree of precision in the planned direction and depth.

(b-c) Maxillary sinus elevation and implant placement were completed as planned in the guide design software are shown. A 10-mm long implant was placed, with excellent initial fixation at around 30 N.

Case 3

This was a case of a reverse sinus floor with a convex sinus floor prone to rupture due to high tension during membrane elevation **(Fig. 17).**

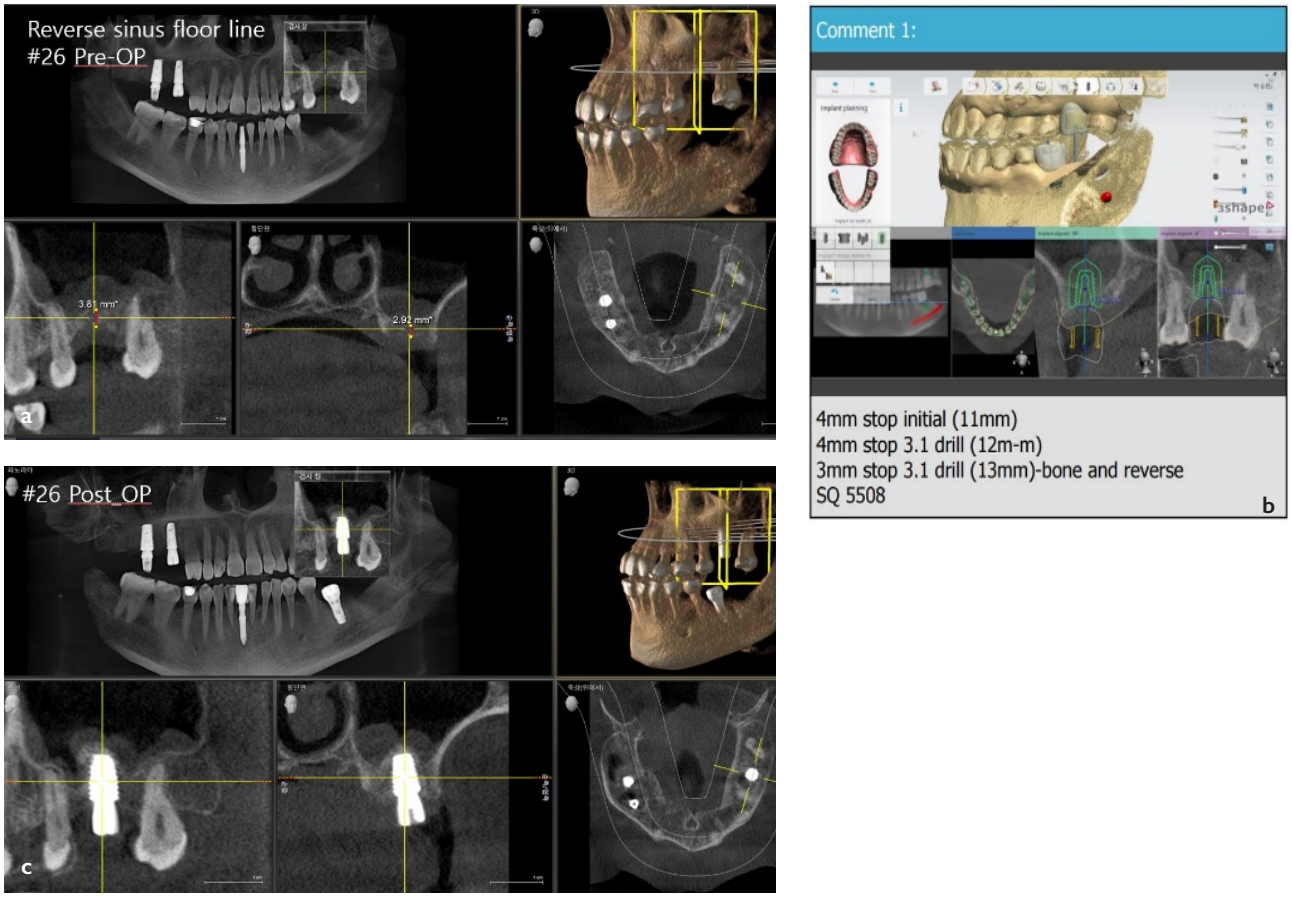


Fig. 17(a-c). (a-b) In the #26 region, the remaining bone's height was 2.9-3.8 mm, and we planned to place an 8-mm long implant after maxillary elevation of 4-5 mm using the SQ Sinus Guide Kit. In the reverse sinus floor, the membrane's excessive elevation may lead to its rupture. Therefore, it is recommended to raise the membrane up to 4-5 mm.

(c) The implant was placed, and a dome-shaped membrane elevation and bone graft were performed around the implant without membrane damage.

Case 4

This was a case of implant placement after elevating the membrane on the steep slope of the maxillary sinus floor **(Fig. 18).**

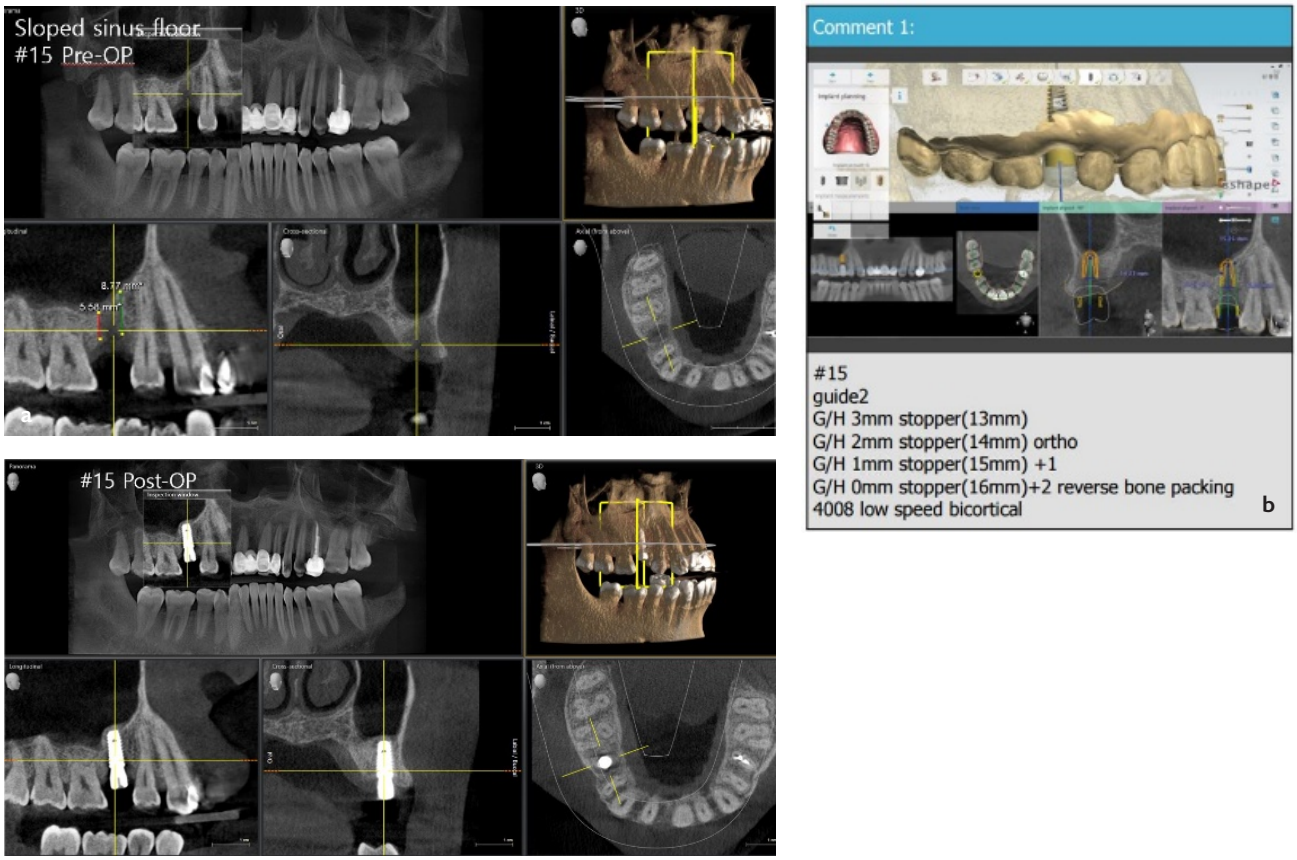


Fig. 18(a-c). (a-b) The placement of a #15 implant was planned, and the residual bone's height was 8.77 and 5.58 mm in the mesial and distal regions, respectively. We planned the placement of a 10-mm long implant with four types of stoppers (3, 2, 1, and 0 mm) to sequentially raise the sinus floor slope and perform bone grafting.

(c) CT images after implant placement. The membrane is uniformly separated along the slope, and the bone graft is uniformly performed.

Conclusion

Since the shape, membrane thickness, lesion, and bone quality of the maxillary sinus are varied and complicated for each patient and each site, lateral sinus elevation is challenging even for experienced clinicians; there is always the possibility of failure.

Since inexperienced practitioners are more likely to experience failure, various kits have been developed to enable safe and convenient maxillary sinus elevation using a digital guide system; the SQ Sinus Guide Kit represents one of those options.

The author, in collaboration with the Dentis research team, has spent nearly 2 years developing, preparing, and releasing a kit that allows clinicians to perform guided surgery for 3D elevation in a variety of complex sinus and lower bone shapes simply by following the manual. Such efforts are expected to provide a helpful tool for many clinicians, and further advancements in surgical kits are desired in the future.

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Choice of restoration method based on the vertical restoration space of the Edentulous patient

Jonghyun Park, DDS, MSD

Introduction

Multiple elements need to be considered in the treatment of the edentulous patient. In addition to concern for his or her financial capabilities, the treatment plan should be adjusted to accommodate the patient's bone and soft tissue condition. Moreover, caution must be exercised in any simultaneous improvement of facial morphology.[1] **(Fig. 1)**

In maxillary edentulous patients, the choice of prosthesis has significant effects on the facial morphology and hence the treatment plan cannot be determined on patients' preference.
Classification introduced in this publication by Ahuja in 2011 will be used to present my clinical cases.[2]

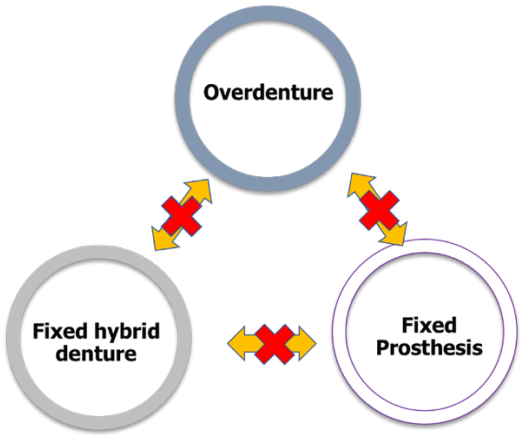
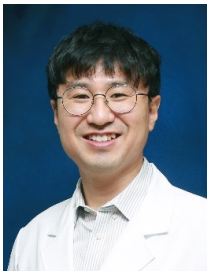


Fig. 1. Selecting a rehabilitation method for edentulous patients



Jonghyun Park

Dr. Jonghyun Park graduated from Gangneung-Wonju National University College of Dentistry, and then completed postgraduate residency and achieved MSD in Prosthodontics at Department of Prosthodontics, Gangneung-Wonju National University College of Dentistry. He is a board-certified prosthodontist. He serves as a director of Korean Academy of Esthetic Dentistry. He received Dentphoto Award in 2014. He maintains a private practice at the Seosan Doori Dental. Clinic in Seosan City.

Case Report

1. Class I – Vertical space is 15mm or above.

Excessively absorbed Alveolar ridge.

- Horizontal and Vertical cantilever should be considered.
- A locator, a solitary method, and a magnet attachment may be used.
- However, a bar overdenture, which enables splinting is more advantageous.
- Improvement of facial morphology is challenging if fixed prosthesis is used for restoration, and
hence it is not the preferred choice.

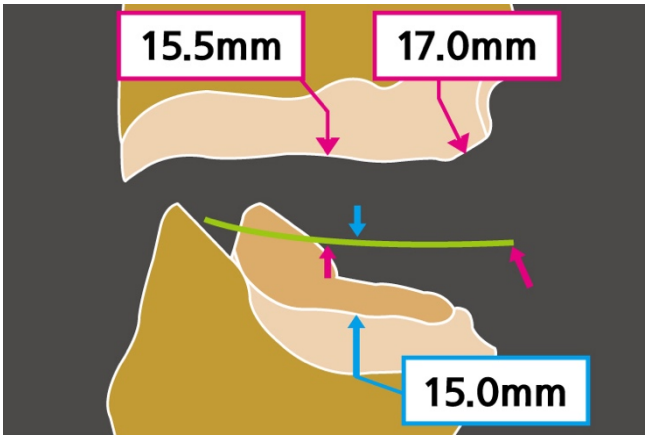


Fig. 2. Vertical space of 15mm or over
<Source : Publication by Ahuja, 2011 >

Bar overdentures are preferable for Class I clinical cases. **(Fig. 3)**

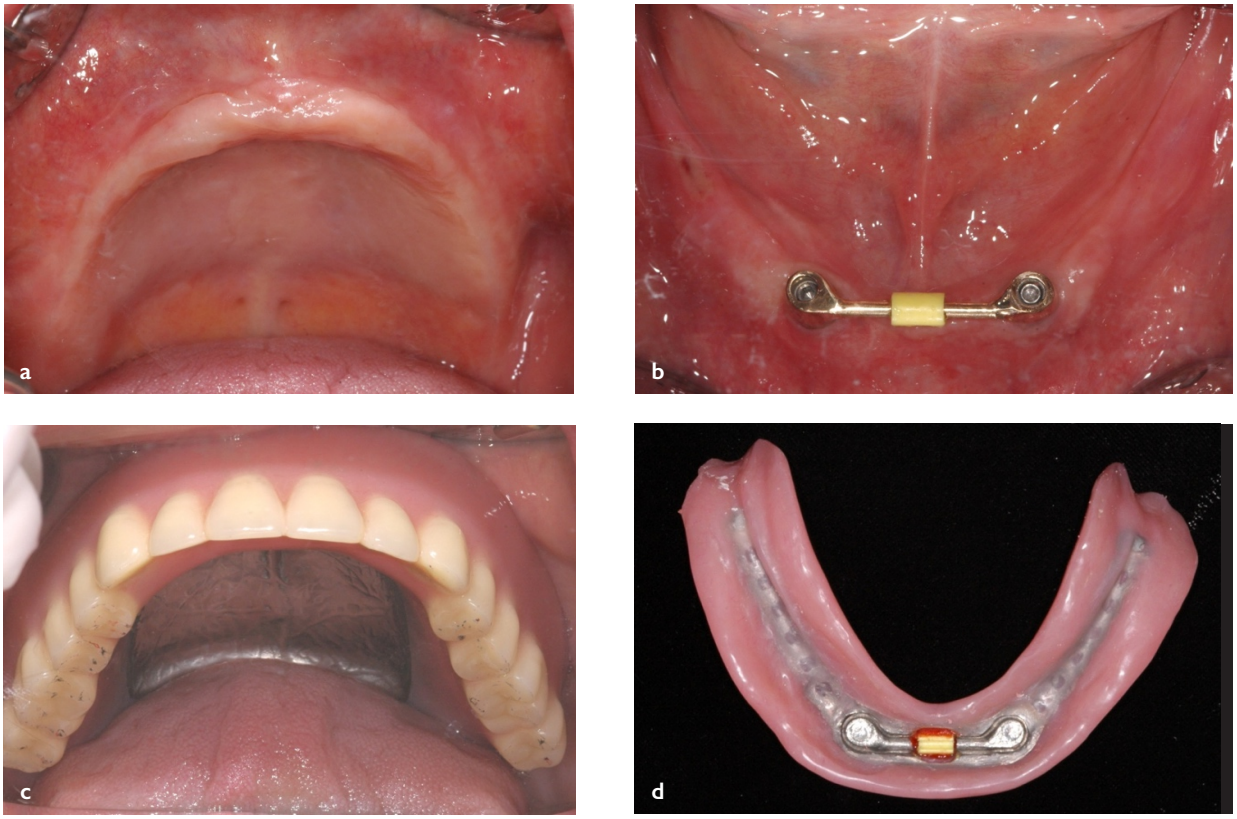


Fig. 3a-d. Maxillary complete denture, Mandibular bar overdenture

The reason for preferring overdentures is the clear advantage it provides for the improvement of facial morphology. Mandibular bar over denture and Maxillary complete denture cases are shown. Facial morphology was restored because the tissue loss space was restored with a denture. **(Fig. 4)**

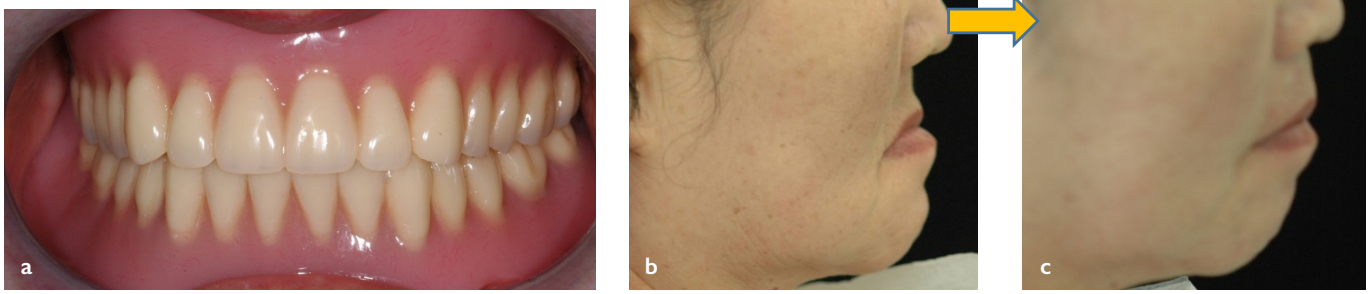


Fig. 4a-c. Changes in the facial morphology before and after dentures

2. Class II – Vertical space is between 12~14mm

- Moderately absorbed alveolar bone.

- Mostly right after the extractions due to periodontal diseases.

- Overdenture is an appropriate method to support the lost facial morphology.

- Implant clasp RPD is also being tried for mandibles where facial support is less important.

- Considering the smile line, we are also trying a hygienic fixed prosthesis

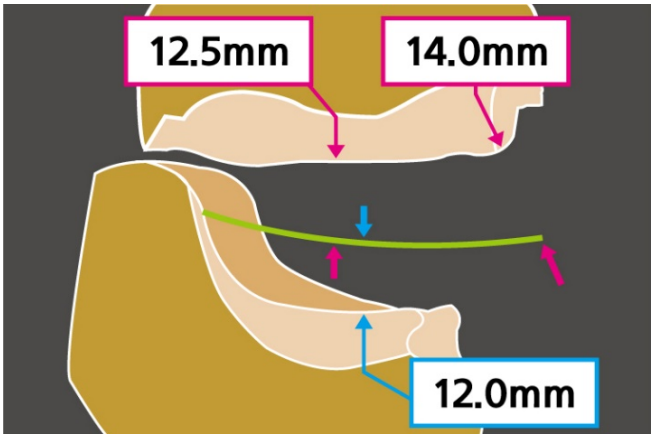


Fig. 5. Vertical space of 12~14mm <Source : Publication by Ahuja, 2011 >

Overdentures are the best choice for supporting a lost facial morphology. **(Fig. 6)**

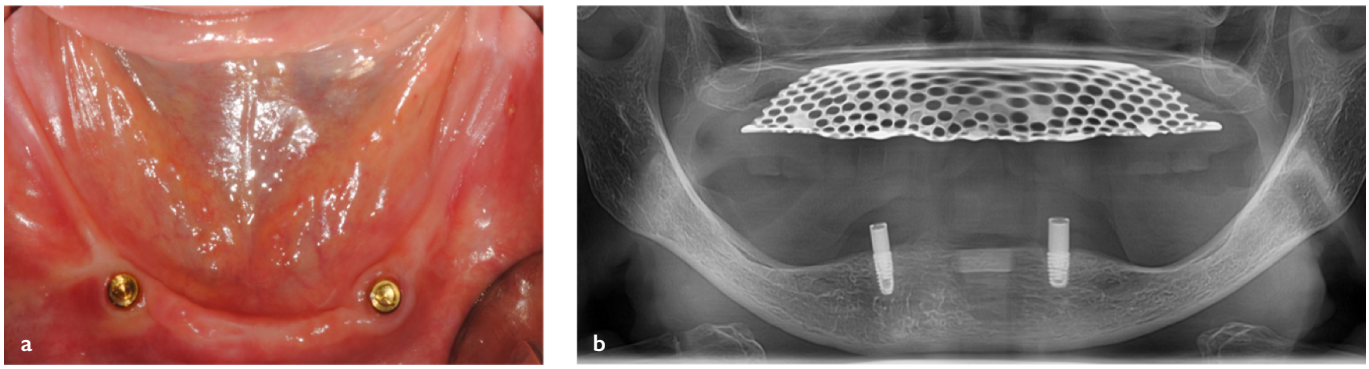


Fig. 6a-b. Locator overdenture

When arranging the maxillary teeth, the amount of tissue loss is taken into account as much as possible with aesthetic aspect as the priority. The depth of the contour of the denture should be chosen after the implant impression. **(Fig. 7)**

The implant impression and denture here are from two different patients.

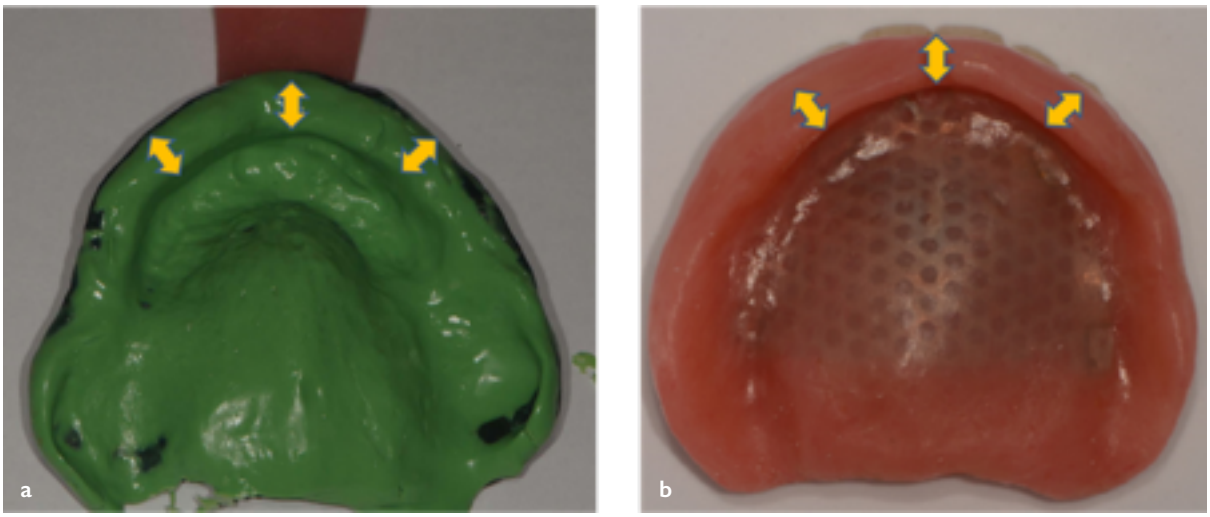


Fig. 7a-b. Depth of the contour of the denture

For lower jaws, in which the importance of function outweighs the aesthetic aspect, implant clasp RPD is a viable choice. However, this may not be the case for the maxillary region which is essential for physiognomy improvement. **(Fig. 8)**

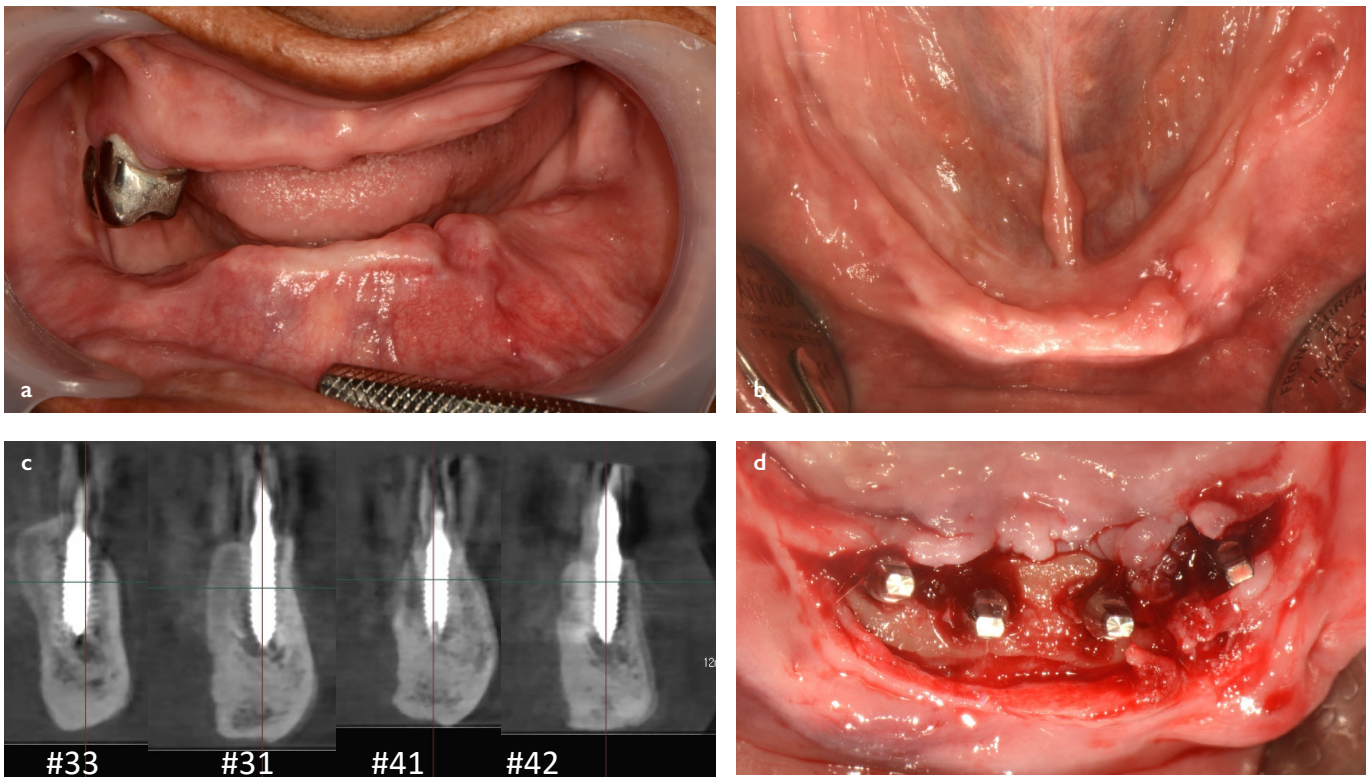


Fig. 8a-d. Implant clasp RPD using one body implant Φ3.0 * 10~11.5

For the lower jaw, in which facial support is less important, an implant clasp RPD is also a viable choice. **(Fig. 9)**

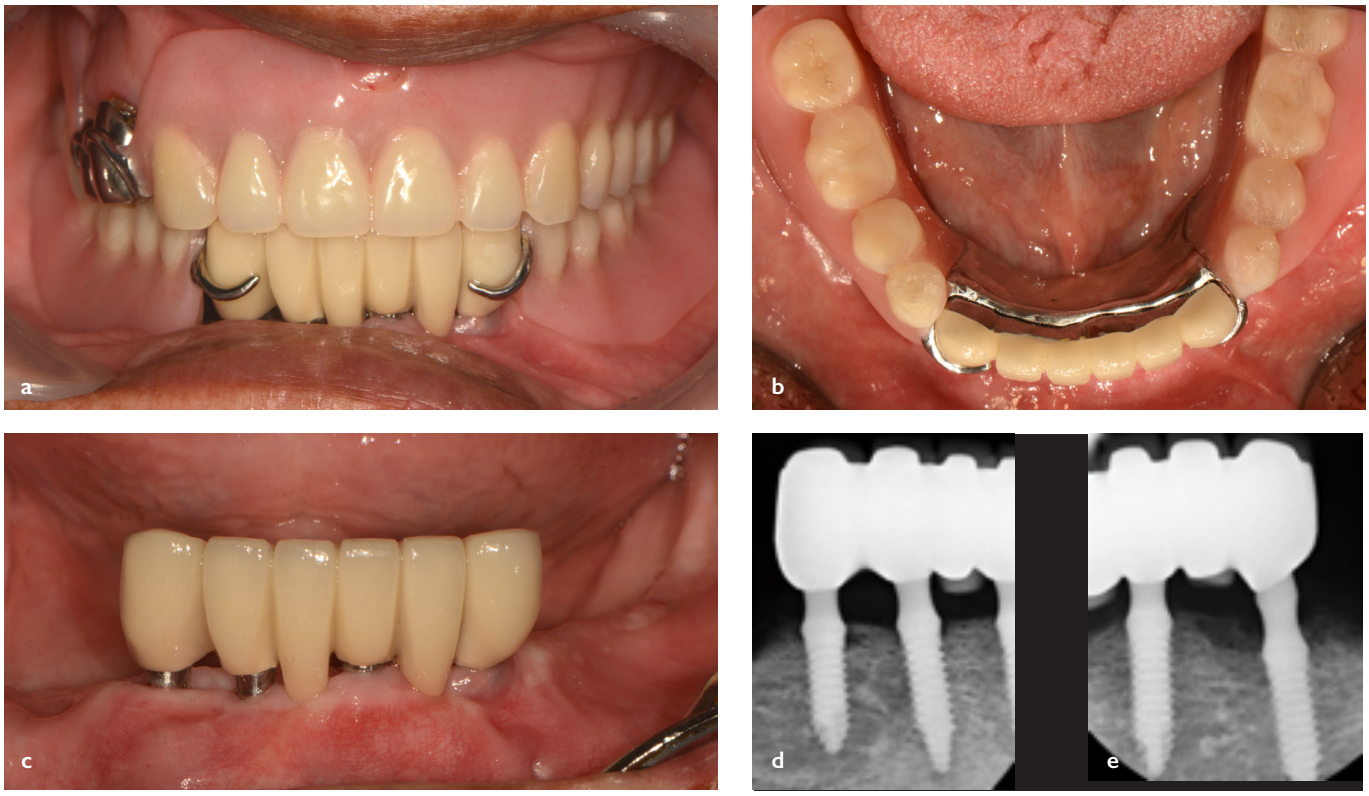


Fig. 9a-e. Implant clasp RPD

When using a fixed prosthesis for restoration, the smile line and convenience in maintaining oral hygiene should be considered during the designing process. **(Fig. 10, 11)**

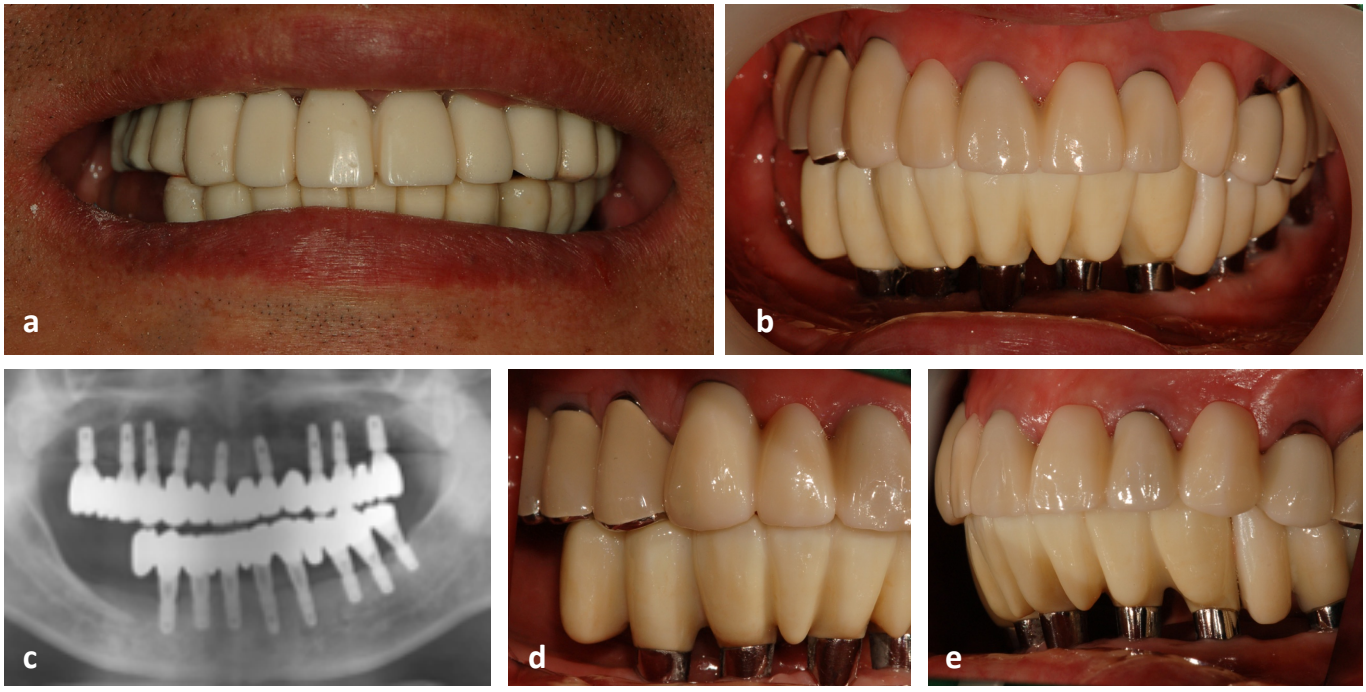


Fig. 10a-e. Hygienic fixed prosthesis with consideration of the smile line

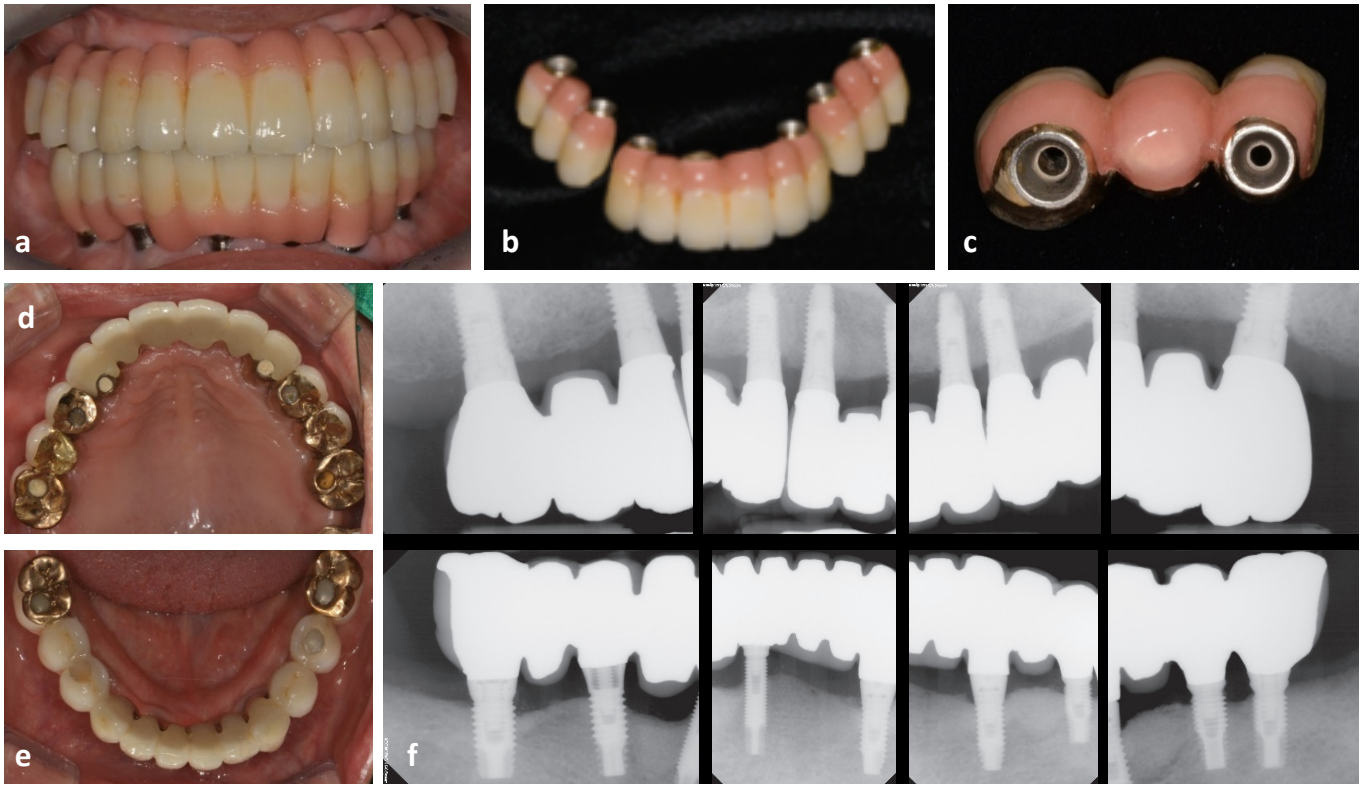


Fig. 11a-f. Pink porcelain fixed prosthesis considering the smile line (Dr. Jae-Oak Shin)

3. Class III – Vertical space between 9~11mm

Class III cases with limited vertical spaces that are indications of fixed prosthesis restoration will be examined. **(Fig. 12)**

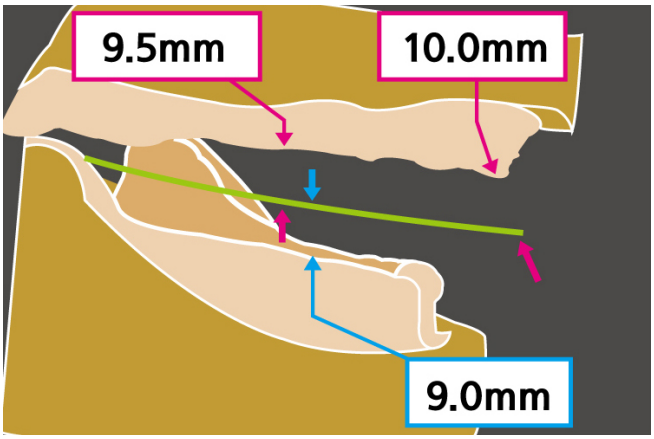


Fig. 12. Vertical space of 9~11mm <Source : Publication by Ahuja, 2011 >

A patient with a main complaint of an attachment fracture during a visit. **(Fig. 13)**

Caution should be taken when overdentures are used for restoration in limited vertical spaces, since continuous problems such as fractures may occur.

After 6 years, implantations were used in the #43, 44, and 45 region for additional restoration.**(Fig. 14)**

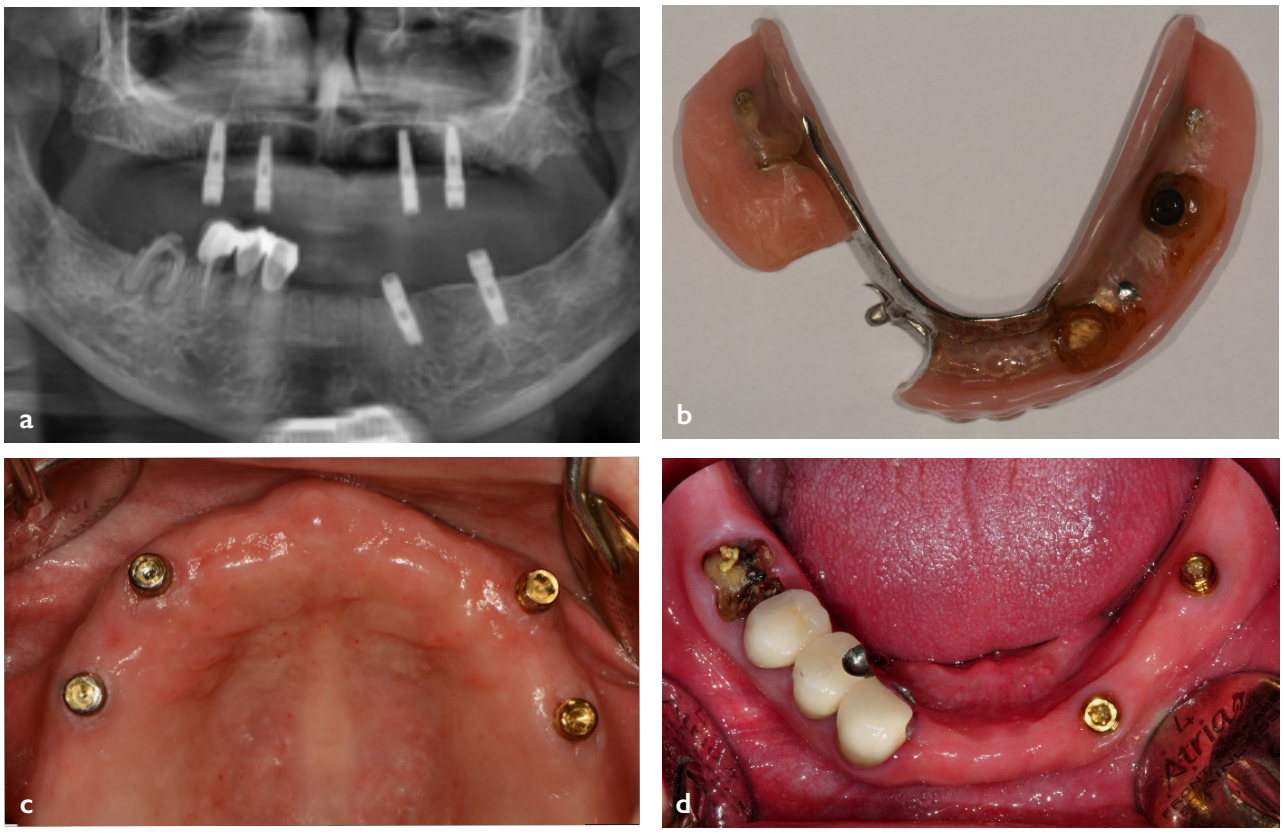


Fig. 13a-d. Visit after overdenture restoration at another hospital

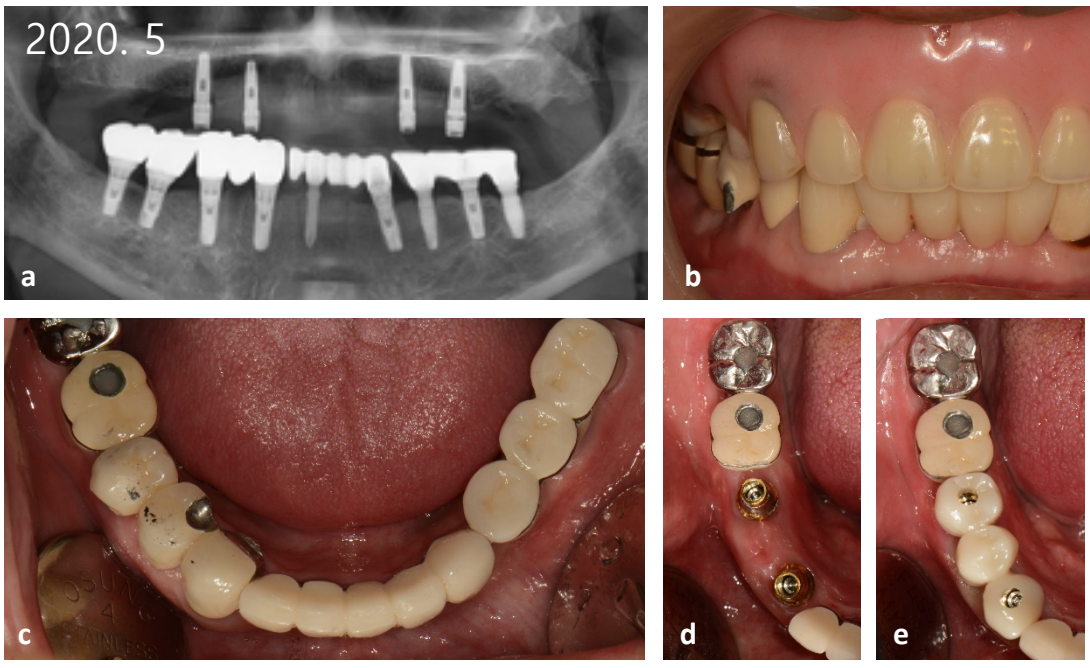


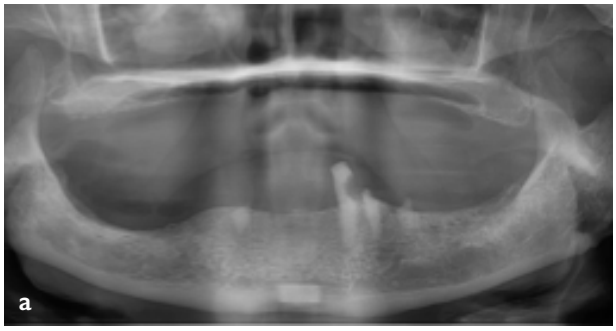
Fig. 14a-e. Fixed prosthesis in combination with the existing implantation was used for restoration at the lower jaw

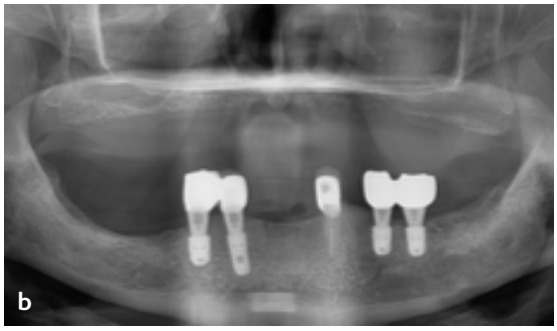
When the amount of tissue loss is small, patients prefer economic restoration and complete dentures for the antagonist teeth. Implant clasp RPD restorations may also be attempted. **(Fig. 15)**

Fig. 15a-c. Vertical space of approximately 9mm. Implant clasp RPD Restoration at lower jaw

When the loss of anterior tissue is small, but the loss of posterior tissue is significant and the posterior implantation is difficult, the anterior region can be restored with implantation and the posterior region can be restored with implant clasp RPD.

Implantation may be challenging at the right anterior region, hence implants may be used for restoration up to the premolar teeth, and the right anterior region restored with RPD. **(Fig. 16)**





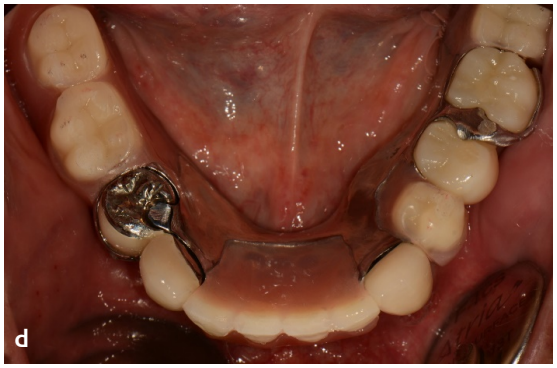


Fig. 16a-d. Mandibular Implant clasp RPD

Fixed prosthesis was completed in a case with vertical space of 11mm based on premolar teeth. **(Fig. 17)**

While the facial morphology can be better improved, a fixed prosthesis is sufficient for restoration.

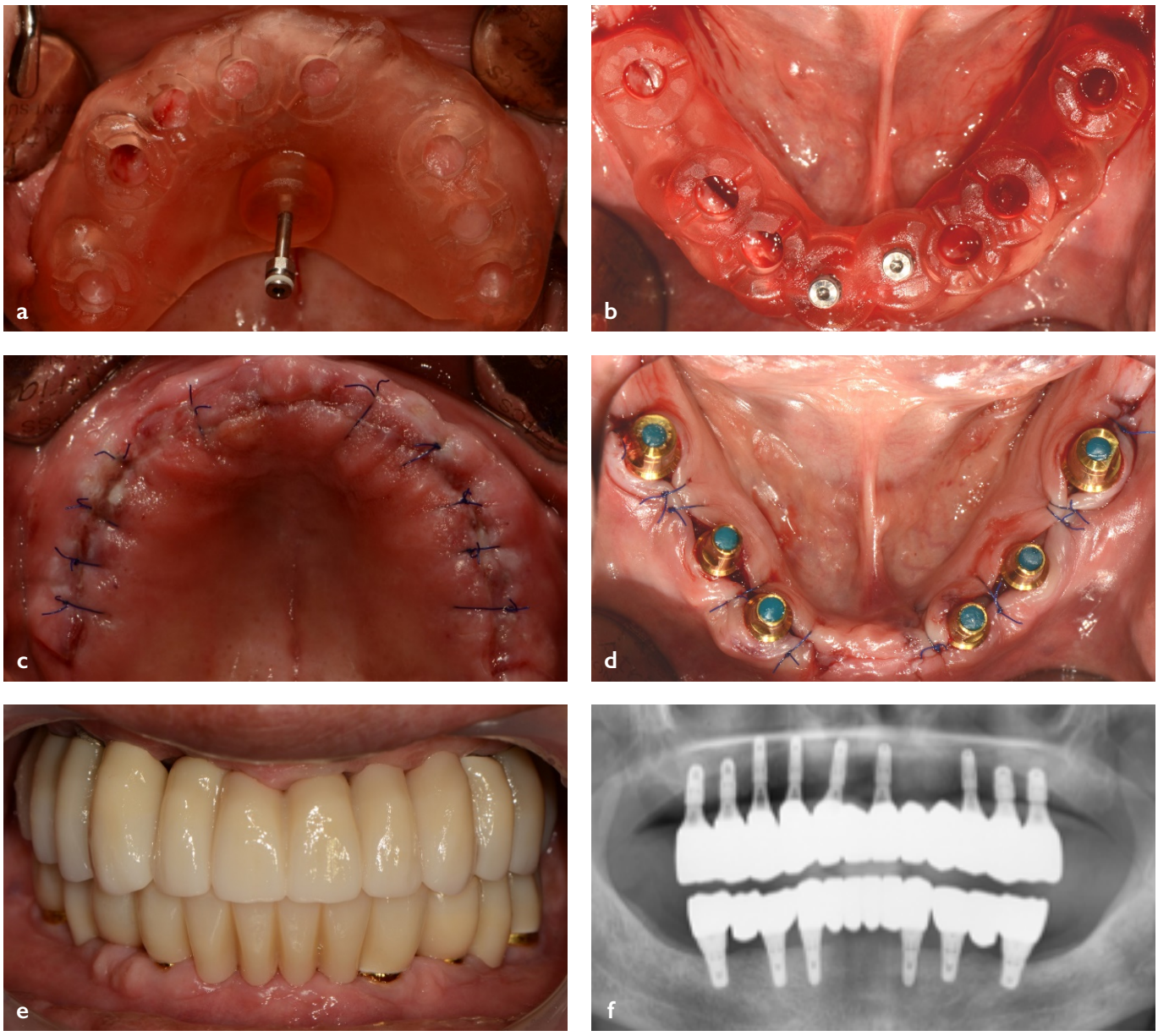


Fig. 17a-f. Case of premolar based vertical space of 11mm

Many cases categorized in Class III are appropriate for both complete and fixed prosthesis restoration.

A maxillary complete denture was performed here, but the patient's financial condition permitting, fixed prosthesis restorations are often possible as well. **(Fig. 18)**

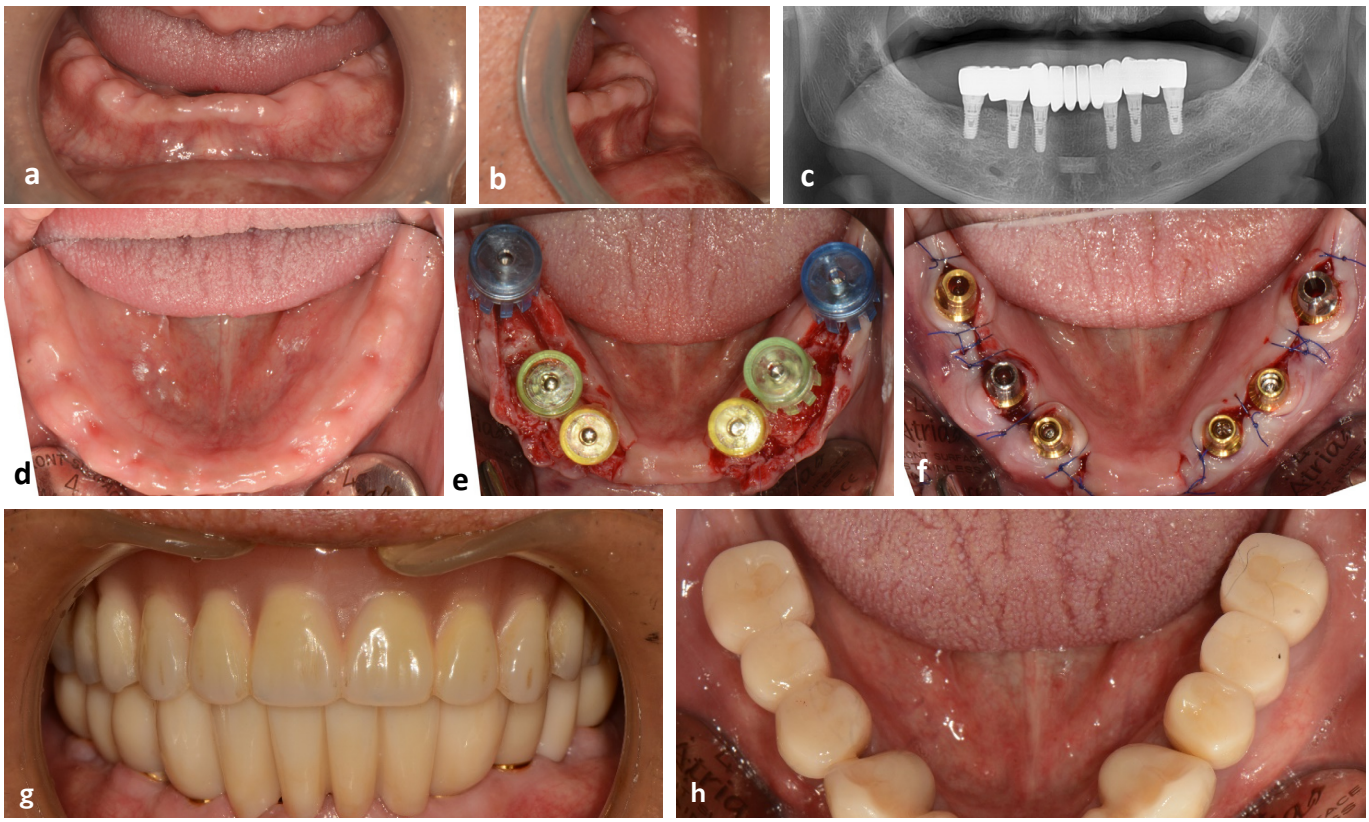


Fig. 18a-h. Maxillary complete denture, Mandibular fixed prosthesis

4. Class IV – Vertical space of 8mm or below.

- An Implant overdenture is not indicated for cases with almost no loss of alveolar bone.
- Fixed prosthesis restoration is advantageous.
- Cases with a restoration space of 8 mm or less, implant clasp RPD possible

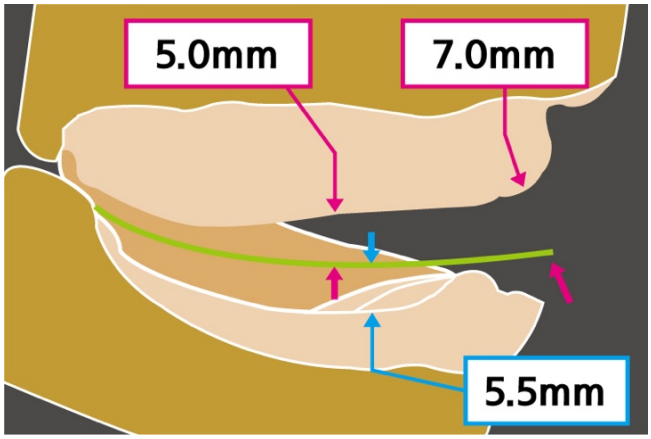


Fig. 19. Vertical space of 8mm or below <Source : Publication by Ahuja, 2011 >

A complete denture was planned due to insufficient residual bone in the posterior region, but the patient complained of excessive lip support after the denture. **(Fig. 20)**

Indication for fixed prosthesis.

Restoration was completed with a combination of sinus bone graft and a fixed prosthesis. **(Fig. 21)**

Fig. 20a-e. Excessive lip support in patient with preserved alveolar ridge due to the use of denture.

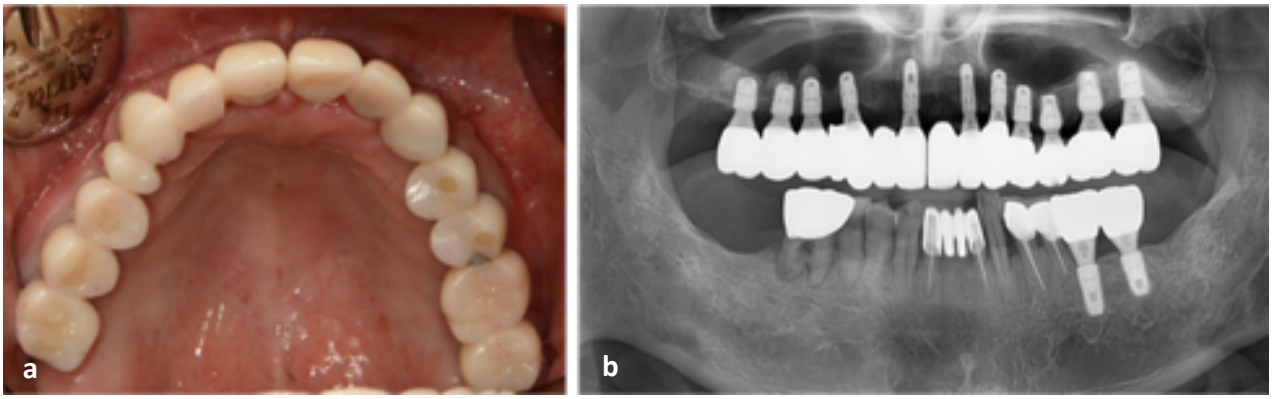


Fig. 21a-b. Sinus bone graft combined with fixed prosthesis

When there is almost no loss of alveolar bone, a fixed prosthesis is appropriate. If an overdenture is used for restoration in the limited space, loss of vertical space may become excessive and the denture may be fractured constantly.

Restoration completed with a fixed prosthesis. **(Fig. 22, 23)**

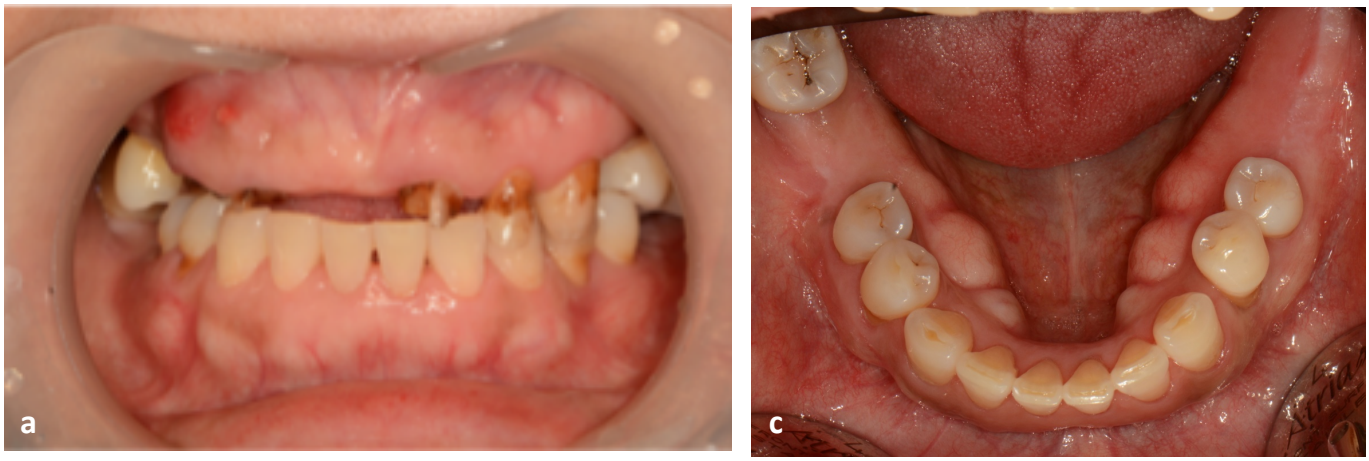


Fig. 22a-c. Maxillary complete denture, Mandibular fixed prosthesis

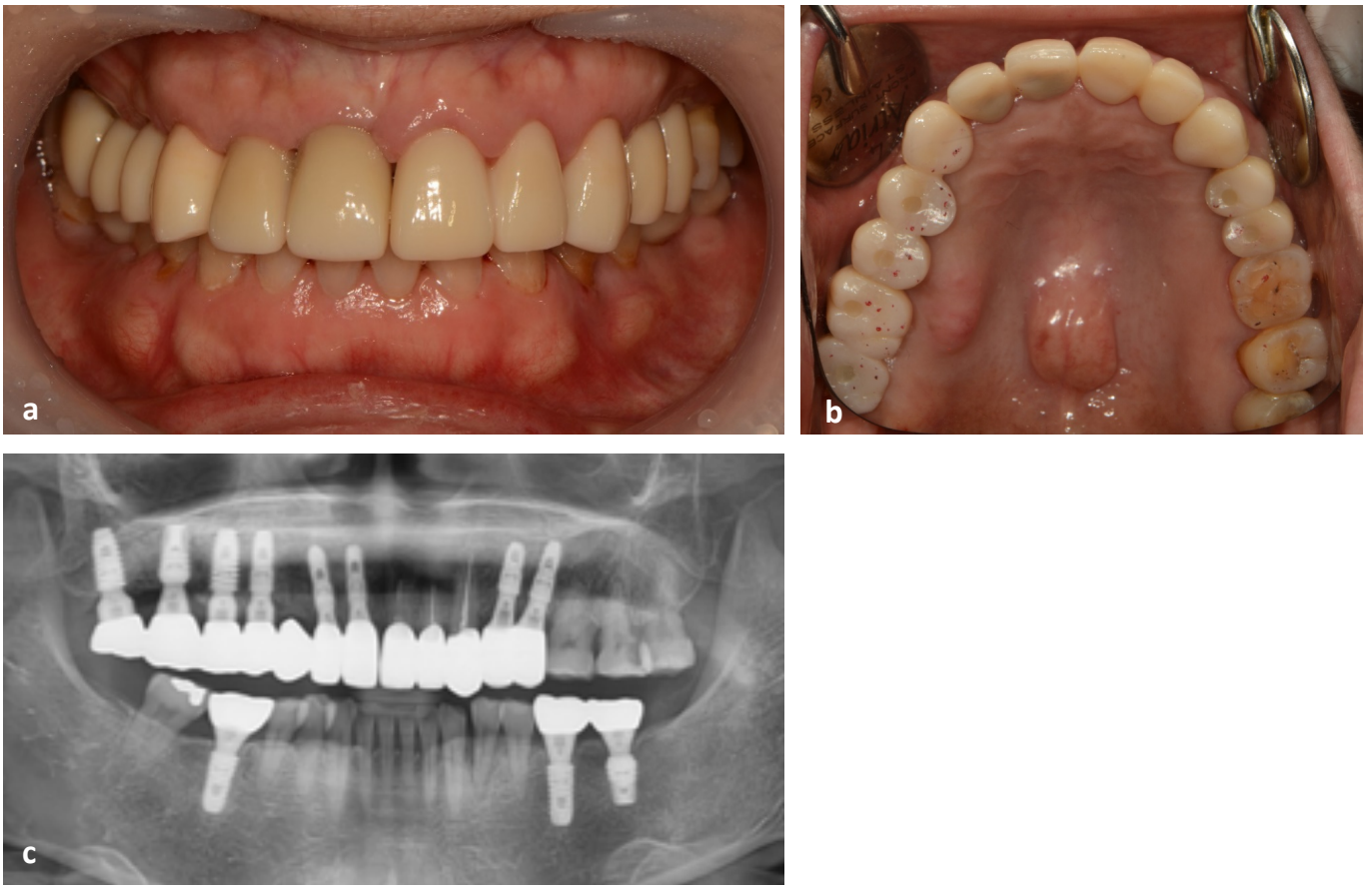


Fig. 23a-c. fixed prosthesis

Clinical case of vertical space of 8mm. Mandibular implant clasp RPD was used for restoration. **(Fig. 24)**

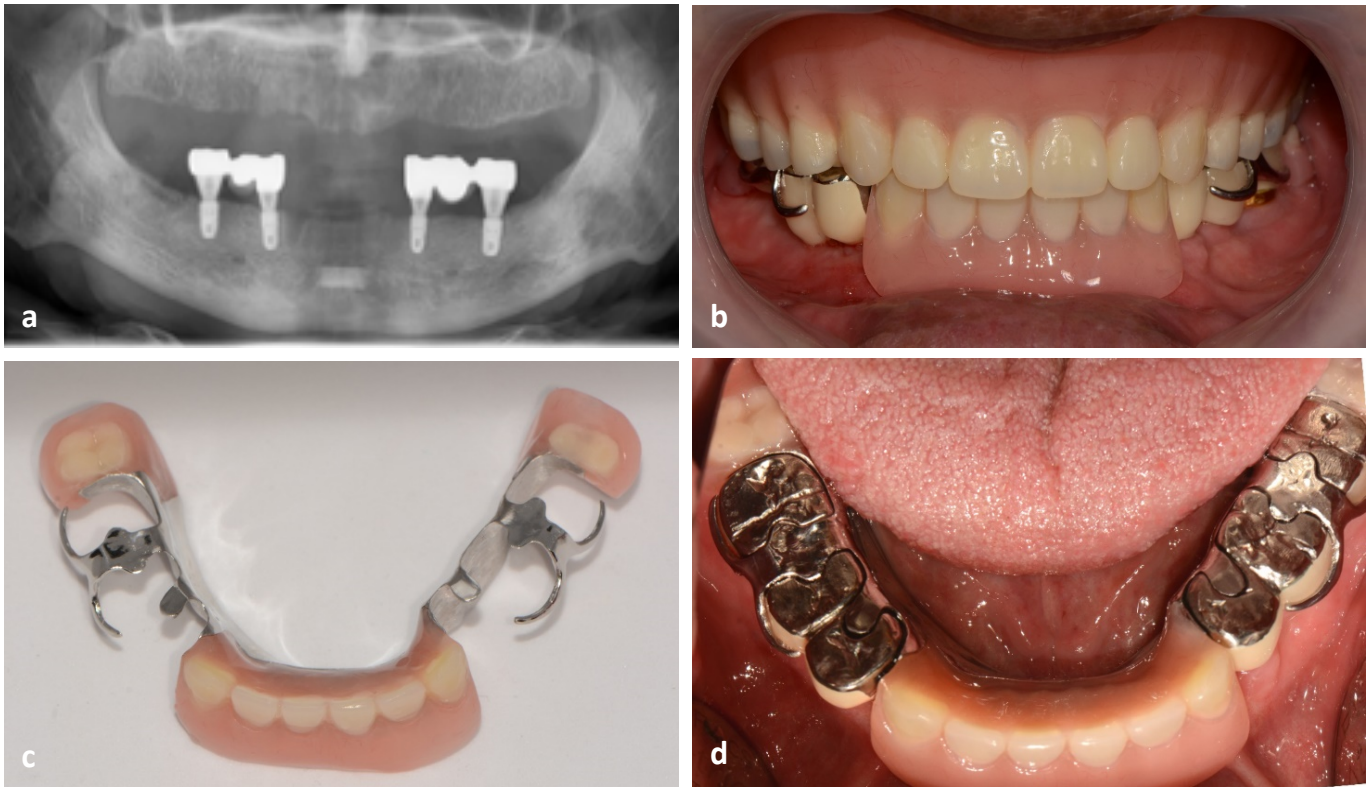


Fig. 24a-d. Mandibular implant clasp RPD

Conclusion

1. For Class I cases with a large amount of tissue loss, a bar overdenture should be the first choice, and a fixed prosthesis should not be considered.

2. For Class II cases with moderate tissue loss, an overdenture is the common choice, and a mandibular fixed prosthesis may also be considered.

3. In Class III cases with small tissue loss, a fixed prosthesis is preferred and an overdenture should be approached with caution.

4. In Class IV cases with almost no loss of alveolar bone, an overdenture may cause multiple complications, and a fixed prosthesis is the most appropriate treatment choice.

	CD	Bar overdenture	Locator overdenture	Fixed hybrid denture	Fixed prosthesis	IARPD
Class I	+++	+++	+	+		
Class II	+++	++	+++	+++	++	+
Class III	+++		+		+++	+++
Class IV					+++	++

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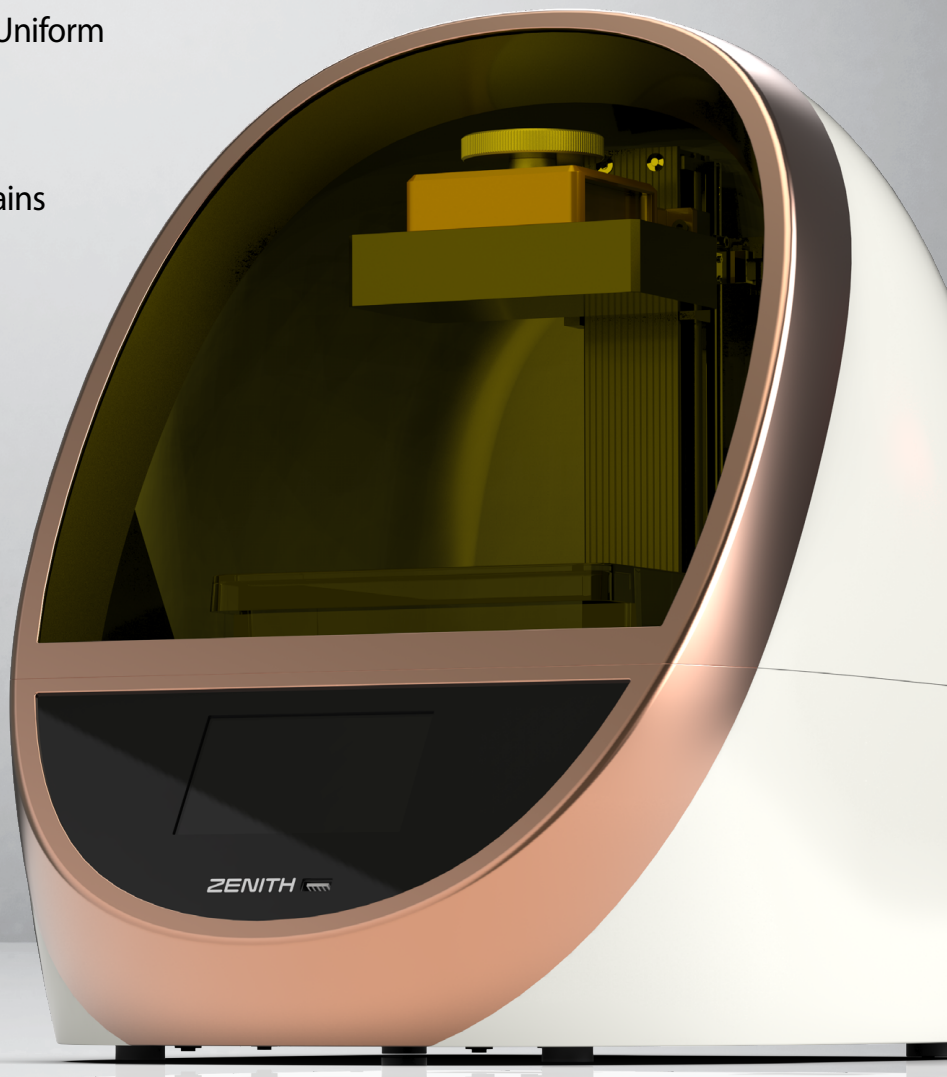

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Dental considerations in patients taking osteoporosis drugs and bone-modifying agents (BMAs) : Part (1) – Understanding indications and medications

Wonse Park, DDS, MSD, PhD

Introduction

Bisphosphonate-related osteonecrosis of the jaw (BRONJ) was first described by Marx in 2003; however, osteonecrosis of the jaw (ONJ) remains a controversial topic among doctors and dentists treating patients with osteoporosis and cancer.[1,2]

Doctors who treat osteoporosis have emphasized complications, such as fractures, reduced quality of life, and death when osteoporosis was neglected, and doctors who treat cancer also have emphasized skeletal related events (SREs) such as pain, bone fractures, and hypercalcemia, which occur when antiresorptive agents are not administered in patients with cancer.[3]

However, from a dentist's perspective, even if the incidence is low, both tooth extraction and dental implant surgery are needed to restore oral function. Also, even though dentist follow the academically proven treatment sequence, failure can be happened in patients with osteoporosis or cancer and may result in medical litigation.

The most fundamental problem of this phenomenon is that the cause of the disease remains unclear. Moreover, theoretical concepts of accompanying diseases need to be discussed thoroughly between doctors and dentists to gain a clearer perspective of the situation and avoid conflicts. Simply put, despite the low incidence of ONJ and importance of medical treatment, doctors need to understand that invasive dental treatment frequently required by the dentist.

In addition, even seemingly healthy teeth may suddenly require extraction depending on patient factors. Although dentistry is important in terms of tooth extraction and implant treatment, it should also be considered that if osteoporosis is left untreated for a long time, the patient may die due to fracture.

Hence, it should be recognized that bone-modifying agents (BMAs) may be used to improve the quality of life of patients with cancer and prevent tumor growth. Based on these points, it is necessary to establish an individualized dental treatment plan, which is entirely based on the knowledge and judgment of the dentist.

In this series, I like to explain the basic knowledge on osteoporosis, cancer, BMAs, and what dentists need to know about medication related osteonecrosis of the jaw (MRONJ).

Wonse Park

After graduating from Yonsei University College of Dentistry, Wonse Park completed an internship and training course at the Department of Oral and Maxillofacial Surgery at Yonsei University Dental Hospital. After serving as a public health doctor, he again served as a lecturer and full-time clinical instructor at the Department of Oral and Maxillofacial Surgery, College of Dentistry, Yonsei University. Since 2006, he has served as an assistant clinical professor, clinical associate professor, associate professor, and professor at Advanced General Dentistry, Dental Hospital, and Yonsei University, which were first established in Korea. He served as a visiting scholar at the Department of Oral Surgery and Pharmacology at the University of Pennsylvania and is currently the head of the Department of Advanced General Dentistry, Yonsei University School of Dentistry.

1. Basic knowledge about osteoporosis that dentists need to know

Osteoporosis is a condition wherein an empty space is created in the bone tissue. Academically, it refers to a condition with weakened bone strength due to a decrease in the amount of bone, resulting in impairments, thus leading to fracture occurrence. In 1994, the World Health Organization (WHO) defined it as "a systemic skeletal disease characterized by a decrease in bone mass and microstructural abnormalities, resulting in weakened and brittle bones." In 2000, the National Institute of Health defined it as a skeletal disease with an increased risk of fracture due to weakening of bone. These definitions emphasize the importance of understanding osteoporosis, as it can cause functional problems such as fractures. As osteoporosis progresses, the thickness of cortical bone decreases, and absorption occurs mainly in the inner cortical layer of the bone. In addition, the microarchitecture of the trabecular bone of the medullary as well as the cortical bone is destroyed. These changes in the cortical and medullary bone affect bone strength and increase the risk of fracture. Bone strength is affected by bone quality and quantity. Bone mass is mainly expressed by bone mass and bone size, which is evaluated by bone density test. Moreover, bone quality is evaluated by bone structure, bone turnover rate, mineralization level, and microdamage accumulation.[4]

However, osteoporosis is often diagnosed at a progressed stage, because pain is not usually an initial symptom. Due to the physical characteristics of the bones, no specific symptoms appear in the early stages. However, one of the initial symptoms is height reduction, as the vertebra is weakened and becomes kyphotic or compressed. In severe cases, the vertebra cannot support the weight and may even become distorted without trauma. In addition, the risk of fractures increases, and in severe cases, these may occur when bending the back or coughing. It is known that fractures of the hip joint and vertebrae are common in patients in their 70s, while wrist fractures are more common in women aged 50 to 70 years.

Osteoporosis also has a high prevalence. According to an epidemiological study of the United States, most patients with osteoporosis is over 50 years of age, and those over 70 years have limitations in daily activities due to osteoporosis. According to recent statistics from the International Osteoporosis Foundation, worldwide, 1 in 3 women over the age of 50 years and 1 in 5 men will experience osteoporotic fractures in their lifetime.5 Every fracture is a sign of another impending one. This risk of fracture is increasing due to the aging society. In 2040, a two- or three-fold increase in the incidence of hip fracture in the United States is expected. The probability of death within 6 months after hip fracture is known to be 2.8-4 times higher than that of the group without fracture, which is known to be caused by the high incidence of comorbidities, such as arrhythmias, thrombosis, and pulmonary transgenesis.

Bone mineral density test is useful for diagnosing osteoporosis, evaluating fracture risk, monitoring changes in bone density over time, and planning treatment strategies. Bone density measurement is performed in various regions, including the lumbar spine, hip joint, wrist, and ankle using diverse equipment, such as dual-energy X- ray absorptiometry (DXA), quantitative computed tomography (QCT), and ultrasound; however, DXA is most used. In order to interpret DXA, the age, sex, weight, height, and race of the patient along with appropriate posture and region of interest (ROI) must be considered.

T and Z scores can be obtained from the DXA test. The T and Z scores aid in categorizing the patient's bone density, compared to that of young people and those of similar age, respectively. When the bone mineral density of the population is established, it is considered the highest at the mean point while drawing a normal distribution. It gradually decreases according to the standard deviation unit; bone density is expressed with this standard deviation value. A T score of 0 indicates that the bone density is the same as the average value of the young people group, while a score of -1 indicates a decrease in bone density by 1 standard deviation when the average/standard deviation of the young people considered.Hence, it should be noted that scores of 0, -1, -2, and -3 follow the standard deviation value in the normal distribution, and that as the negative value increases, bone density prominently decreases. The T score is mainly used for clinical diagnosis. According to the classification of WHO, a score of -1.0 to -2.5 indicates the pre-osteoporosis stage, osteopenia, whereas a score of less than -2.5 indicates osteoporosis. Dentists also need to know these diagnostic criteria, because awareness of the osteoporosis severity is needed before planning for an individualized treatment. **(Fig. 1)**

Figure 1: Bone Density Scores and Standard Deviation

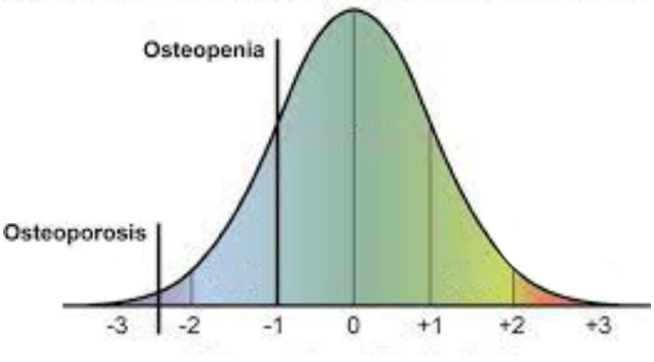


Fig. 1. The T score used to diagnose osteoporosis is a number representing the standard deviation in a normal distribution graph. That is, a T score of -1 means that the patient's BMD was reduced by one standard deviation from the normal distribution graph calculated by calculating the BMD of a young person.

Osteoporosis treatment aims to maintain the current bone mass by increasing bone formation or preventing bone loss. Regular exercise, frequent sunbathing, and consumption of calcium-rich food may help with vitamin D synthesis. A low- sodium diet is also recommended, since calcium is excreted in the urine along with sodium; thus, smoking and consumption of alcohol, caffeine, processed foods (such as white sugar), and carbonated drinks should be avoided. Appropriate and periodic muscle-strengthening exercises are also important, as this helps in bone stimulation, thus increasing bone density. Vitamin D and physical activity are important in maintaining bone density to prevent falls, and since there should be no neurological problems for proper exercise and activity, active treatment, if any, is required. It is also recommended to adjust medications that affect body balance to prevent falls.

Indications for drug treatment in Korea include 1) a fracture of the femur or vertebra, 2) osteoporosis of the femoral neck, common femur, and lumbar spine (T-value less than -2.5) with secondary causes excluded, and 3) patients with osteopenia, history of other fractures, presence of secondary causes, and if the risk of femoral fracture or risk of major osteoporotic fracture (clinical spine, forearm, and humerus) is more than 3% or 20%, respectively, according to the FRAX model by WHO.

2. Malignant tumors requiring BMAs that dentists need to know

BMAs are also administered for patients with diseases other than osteoporosis, including those with malignant tumors such as multiple myeloma, metastatic bone tumor, Paget's disease, so close monitoring is needed for these groups, since they are more susceptible to MRONJ.

Multiple myeloma is a malignant tumor originating from plasma cells, which is responsible for the control of immunity in the bone marrow. White blood cells, red blood cells, and platelets are produced in the bone marrow, which is a sponge-like tissue in the bones. White blood cells consist of neutrophils, eosinophils, lymphocytes, monocytes, T- lymphocytes, B-lymphocytes, and NK cells, among others. Specifically, B-lymphocytes play an important role in protecting the body from infection or disease by producing various antibodies that can act against them by turning into plasma cells when bacteria or viruses enter the body.

Therefore, in blood malignancies, antibody-producing plasma cells are abnormally differentiated and proliferate excessively. In multiple myeloma, the target organ is bone tissue, which becomes spongy when infiltrated, resulting in fractures and reduction in the number of bone marrow which can function normally. This in turn reduces the number of white blood cells, red blood cells, and platelets, leading to infection, anemia, and bleeding, respectively. In addition, it causes bone pain and hypercalcemia when the calcium in the bone is released into the blood due to bone loss. Renal dysfunction may occur due to M protein or hypercalcemia produced by myeloma cells, and decreased urine output, edema, and increased renal function may occur. Treatment includes chemotherapy, radiation therapy, hematopoietic stem cell transplantation, symptomatic treatment, and surgery. BMAs such as bisphosphonate or denosumab are mainly for symptom and hypercalcemia control as well as bone loss prevention.

Paget's disease has an unknown etiology, with 25%-40% cases having a family history of such. It is a chronic and slowly progressing skeletal disease, characterized by brittle bones which can lead to fractures and commonly appears after or during middle age. Most patients do not have any subjective symptoms, but bone pain is a common complaint. The pain is known to be worse at night and can occur in bones of any part of the body. As the disease progresses, the head may grow larger, and the limbs or spine may become curved. Since the exact cause is unknown, only symptomatic treatment is provided. Thus, for pain, aspirin, anti-inflammatory drugs, analgesics, calcitonin, or bisphosphonates are administered.

BMAs are highly likely to be administered to patients with malignant tumors that easily metastasize to bone, especially breast cancer, prostate cancer, and lung cancer. As mentioned, when a malignant tumor metastasizes to bone tissue, SREs, such as pain, fracture, and hypercalcemia occur, which must be treated with bisphosphonate or denosumab.[3]

3. Drugs for osteoporosis and BMA: advantages and disadvantages

Various osteoporosis drugs are being used, and they can be categorized into anti-resorptive drugs and anabolic drugs (bone forming agents) based on their mechanism of action. Osteoporosis occurs when the balance between bone resorption and bone formation is disrupted, resulting in decreased bone formation and increased bone resorption.

Anti-resorptives include bisphosphonate, denosumab, selective estrogen receptor modulator (SERM), hormone replacement therapy, and calcitonin, and bone forming agents include teriparatide, abaloparatide, romosozumab, and strontium.

BMAs are defined as drugs and therapeutic agents that prevent or treat damage caused by bone metastasis of malignant tumors. The main purpose of using BMAs is to prevent SRE such as pathological fractures, spinal cord compression, and hypercalcemia. The antiresorptive drugs used in osteoporosis include bisphosphonate and denosumab, relatively high dose and frequent injection.

Among them, the drugs that can be used in Korea and are administered to most patients are as follows.

Furthermore, among malignant tumors that have not metastasized to bone tissue, patients with stomach cancer or breast cancer should take caution. It is known that the risk of osteoporosis is three times higher in long-term survivors who have undergone gastrectomy for stomach cancer. This is because there is a high possibility of bone loss due to increased parathyroid hormones (PTH) and weight loss.

Osteoporosis can also occur in breast cancer patients and in premenopausal women, since ovarian function is suppressed due to chemotherapy, thus leading to early menopause. In some patients, if ovarian suppression treatment is used instead of chemotherapy, bone density loss like that of oophorectomy may occur. For postmenopausal women, aromatase inhibitors are used as anti-hormonal therapy, as they effectively inhibit cancer progression, lower the recurrence rate of breast cancer, and increase the survival rate, in contrast to tamoxifen, but can increase the risk of osteoporosis.

Osteoporosis drugs

1. Bisphosphonates (BPs)

The bisphosphonate-based compound first synthesized in 1865 was mainly used for industrial purposes such as water softener and corrosion prevention of water pipes through the effect of preventing the deposition of calcium carbonate. Its medical use began with the discovery that pyrophosphate was involved in the calcification process, and it took about 50 years before it was actively used in clinical practice.[2]

BPs are used for multiple myeloma, Paget's disease, metastatic bone tumor, and osteoporosis. It has a similar structure to that of P-O-P of pyrophosphate and has a P-C-P structure in which the center oxygen is replaced with carbon. Depending on which structure is substituted for the R1 and R2 side chains that are bonded to the carbon element, there are many different types of BPs. The three-dimensional structure changes depending on the type of side chain, which affects affinity with bone tissue as well as drug potency and dental- related half-life problems. BPs may be classified into nitrogen containing BP and non-nitrogen containing BP, but MRONJ can occur with all drugs. The mechanism of BP is related to the mevalonate pathway within the cell. The osteoclast absorbs BP attached to the bone surface, which inactivates an enzyme that plays an important role in the mevalonate pathway, and eventually induces osteoclast apoptosis. When apoptosis occurs, the BP absorbed by the osteoclast is released again, and when it is attached to the bone surface again, so effect lasts a long time, and it is difficult to predict when the drug will lose its effect.

Currently, BPs are the first-line drugs used for the prevention and treatment of osteoporosis, and thus are the most prescribed drugs worldwide. For oral preparations, alendronate, risedronate, and ibandronate are frequently used, and injections include ibandronate, zoledronate, and pamidronate. The most used alendronate was reported to reduce vertebral fractures by 44-47% in postmenopausal women, and reduced femur and wrist fractures by 51% and 48%.[6] For alendronate, 70mg formulation is mainly used, but 35mg and 5mg formulations are also available. Recently, a combination formulation including vitamin D or calcitriol has been developed and is on the market. Risedronate was reported to reduce vertebral fractures by 41-49% and non-vertebral fractures by 33-39%, and 5mg, 35mg, 70mg, 150mg formulations are to be taken daily, once a week, 1-2 times a month.[7] Studies on ibandronate showed that vertebral fractures were reduced by 50-62% and non-vertebral fractures were reduced by 50%. The oral dosage form is 150 mg once a month, and the injection dosage form is 3 mg once a month for injection.[8] Since zoledronate is known as the strongest bisphosphonate, it is used in patients with malignant tumors such as metastatic bone tumor as well as osteoporosis. Fracture prevention is known to reduce vertebral fractures by 70% and femur fractures by 40%.[9]

However, in case of oral administration, low absorption in the gastrointestinal tract may be encountered; therefore, it should be taken with enough water (200 mL or more) at least 30 min before breakfast upon waking. Milk, dairy products, orange juice, coffee, calcium, iron, and antacid may inhibit absorption; thus, it should be consumed at least 1 hour later. In addition, since it can cause gastritis and esophagitis, patients should be instructed not to lie down for 1 hour after taking the drug. **(Fig. 2)**

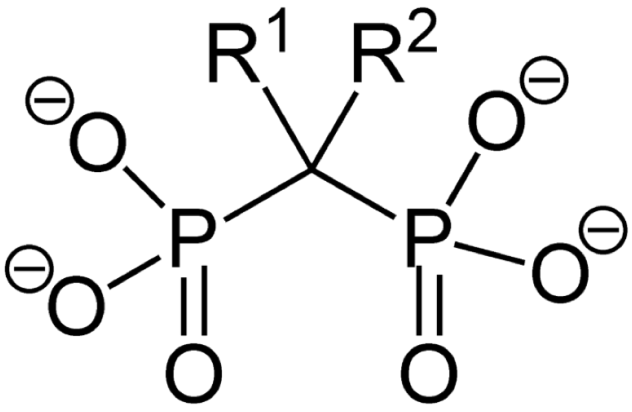


Fig. 2. Structure of bisphosphonate. The three-dimensional structure changes depending on which chemical formula is added to R1 and R2, and accordingly, affinity to calcium hydroxyapatitie and potency of the drug change.

2. Denosumab

Denosumab is also a drug developed for the purpose of inhibiting bone resorption, but the mechanism of action is clearly different. The main action of bisphosphonates is to induce osteoclast apoptosis. In contrast, denosumab is a monoclonal antibody, which acts against the receptor activator of nuclear factor kappa-B ligand (RANKL). It plays a key role in the generation, differentiation, and activation of osteoclasts and inhibits the binding of RANKL to the receptor RANK. By doing so, it has a strong inhibitory effect on bone resorption.[10]

There are two types of denosumab: Prolia® for osteoporosis patients and Xgeva® for cancer patients. Both are administered at monthly intervals; however, in case of Prolia®, 60 mg is injected subcutaneously into the upper arm, abdomen, or upper thigh at monthly intervals, whereas 120 mg of Xgeva® is injected.

Prolia®, along with bisphosphonate, is the first-line treatment for osteoporosis regardless of fracture history. As a result of observing postmenopausal women with osteoporosis for 3 years, compared with the placebo group, vertebral and femoral bone mineral density increased by 8.8% and 6.4%, respectively, while the incidence of new fractures decreased by 68% for vertebral, 20% for non-vertebral, and 40% for femoral fractures.[11, 12]

Although there is controversy as to whether denosumab induces MRONJ, it is known to be similar to or higher than zoledronate.[13-15] According to a recent meta-analysis, the prevalence of MRONJ when denosumab alone is used is about 4%, but when denosumab is used after bisphosphonate use, it is known to be 13%. reported to increase.[16]

A noteworthy advantage and disadvantage of denosumab is that, unlike bisphosphonate, which is absorbed by the bones for a long time, the effect disappears quickly when the drug is stopped. In other words, Prolia® is injected once every 6 months, and if this duration is altered, "rebound associated vertebral fracture" may occur. This means that the effect of the drug is reversible, but if the administration timing is missed, problems such as fractures may occur. Recently, the European Society of Bone Metabolism has reported various research results, such as recommending a combination therapy with zoledronate based on 2.5 years of long-term administration.[17]

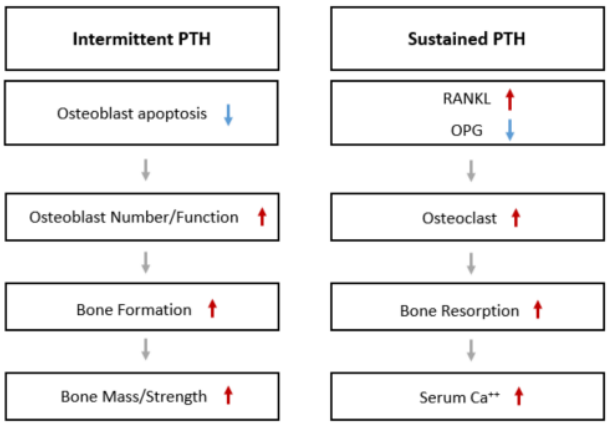
3. SERM

SERM is not a hormone per se, but it binds to the estrogen receptor and can act as either an estrogen agonist or antagonist depending on body tissues. Raloxifene (RLX), a second-generation SERM, and bazedoxifene (BZA), a third- generation SERM are commonly administered orally at a dosage of 60 mg and 20 mg, respectively, daily. SERMs are known to increase vertebrae and femur bone density and significantly reduce vertebral fractures, but they do not show any effect on non-vertebral fractures. This means that although it is effective, it has several limitations in the treatment of osteoporosis and prevention of fractures compared to bisphosphonates.[18, 19]

However, both drugs are known to have no significant relationship with MRONJ and are mainly used as alternative drugs when taking a drug holiday to discontinue bisphosphonate or denosumab for the purpose of dental treatment.

4. Parathyroid Hormones (PTH)

As a promoter of osteogenesis, PTH suppresses apoptosis and promotes differentiation and activation of osteoblasts [25]. In Korea, among the human PTH composed of 84 amino acids, teriparatide, which is PTH (1-34) composed of 34 amino acids at the amino terminus, is available for use, and recently, once-weekly injection PTH (1-34) is also being used.[20-23]



The effect of increasing bone mass is higher than that of general bone resorption inhibitors, and in particular, the effect of increasing vertebral bone mass is high. Moreover, the drug is expensive and needs to be injected subcutaneously every day or every week. Since it is a hormonal drug, there are important points to consider such as careful storage. Additionally, they are recommended for use in elderly women with a previous fragility fracture or a high risk of fracture. In Korea, it can be used for only up to 24 months because osteosarcoma has been reported in animal experiments when high doses are administered. It is important to note that if teriparatide is administered sequentially after using denosumab, bone loss may increase and problems may occur, and thus should be avoided. **(Fig. 3)**

Fig. 3. PTH causes bone resorption when maintained at a high concentration, but is known to promote bone formation when administered at an intermittent low dose.

5. Romosozumab

Sclerostin inhibits the Wnt signaling system, which is important in osteoblastic osteogenesis. Romosozumab is a monoclonal antibody, which acts against sclerostin, promotes bone formation, and inhibits bone resorption.[24, 25]

Bone resorption inhibitors such as bisphosphonates or denosumab should be considered after 1 year of romosozumab administration, because the osteogenic effect is lost only after such time. Brand name of romosozumab is Evenity®, injected monthly, 105mg of two syringes are injected at one time.

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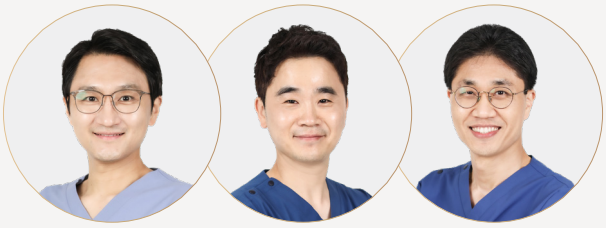

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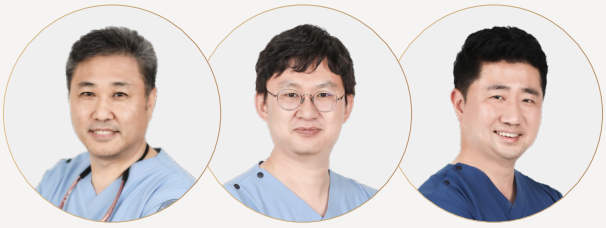

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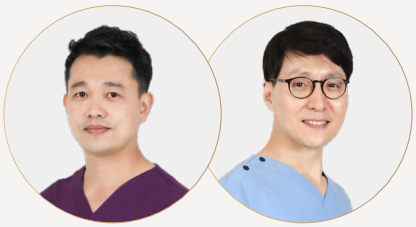

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박철완 원장
보스턴완치과

SEMINAR POINT

Point 1. 원하는 디렉터의 직접 지도하에 임플란트 수술 가능

Point 2. 수술 견학 및 지속적인 멘토링 지원

SEMINAR GUIDE

날 짜 2022.2.12 ~ 4.17 (총 6회)

시 간 (토) 16:00 ~ 22:00

(일) 10:00 ~ 17:00

CURRICULUM

2/12 (토) 임플란트 치료의 진단, 술전 검사, 치료 계획, 절개 및 봉합의 기초

2/13 (일) 임플란트 1차 수술
Hands-on 임플란트 식립 (model)

3/19 (토) 임플란트 2차 수술, 연조직 처치, 임플란트 보철 및 인상
Hands-on 임플란트 인상 및 Gum model 제작

3/20 (일) GBR
Hands-on 절개 및 봉합 (model) / 절개 및 봉합, 임플란트 식립, GBR (pig-jaw)

4/16 (토) 어버트먼트 선택 및 임플란트 보철 & 교합 완성
Hands-on 임플란트 보철물 셋팅 실습

4/17 (일) 상악 전치 임플란트, 디지털 임플란트, 임플란트 가이드 수술
Hands-on 임플란트 가이드 수술

등록	온라인 등록 (OFDENTIS.com) > Community Programs > 교육신청	장소	덴티스 서울 문정 캠퍼스(서울 송파구 법원로11길 7, 2층)
등록비용	1,500,000원	문의	070-4286-0017

주최 TEAM CTS

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