Overcome the Limitation in Surface Processing of Implant! UV Irradiation

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IV. Utilization of UV implant in guide procedure

Reforming change of the implant surface through UV irradiation can induce quick osseointegration and high Bone to Implant Contact (BIC) rate due not only to the increased adsorption of protein but also formation of cell-friendly interface through attachment, proliferation and differentiation of osteoblasts through the following processes: 1) removal of organic matters such as hydrocarbon, etc. from the implant surface, 2) conversion of hydrophobic surface to superhydrophlic surface and 3) induce change in the surface charge from negative to positive.

Therefore, UV irradiated implant is being highlighted as a solution for difficult cases that could only be approached limitedly. Moreover, there is also a demand for assertive application in immediate restoration cases by using surgical guided surgery.

IV. Utilization of UV implant in guide procedure

I believe the Digital Guided Surgery is the hottest issue in the clinical areas at the moment. Digital Guided Surgery is being presented as the solution for extensive utilization and expansion of the treatment domains among the clinicians. Guided procedure, which had been proposed as the solution for cases in which multiple numbers of teeth have been lost, thereby making it difficult to set the reference point for embedding implant, failed to gain support of the dental clinicians due to lower accuracy than expected, prolonged delivery time, higher cost burden and limitation of uses only in specific cases. However, during the recent several years, many of these limitations were solved through advancement of digital imaging technologies (and equipment) and are leading the expansion of the new treatment domains.

[Usefulness of Digital Guided Surgery in clinical settings]

1) Predictability
Precision diagnosis is possible with prediction of the results of the actual procedures through 3D mock surgery on the basis of data obtained through digital imaging devices such as CBCT and oral scanner, etc. As such, it is possible to increase the success rate of implant procedures through considerations for the anatomical structure through the use of digital data rather than simply relying on past experiences. Moreover, it can be the motive force to make communication with the patients more harmonious (Fig. 1).

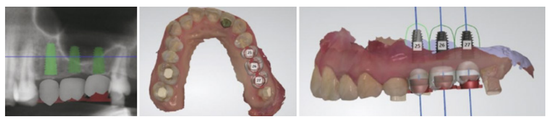

Fig. 1 Data (CT data and intraoral scan data) and mock surgery through digital imaging device

In addition, it is possible to produce temporary prosthetics in advance through mock procedures and it is possible to substantially improve even the aesthetic aspects by setting the prosthetics immediately after embedding the implant.

2) Reduce prosthetics stress (tow-down format)
The latest software for mock procedures for implementation of Digital Guided Surgery sets the location and size of the lost tooth first as illustrated in Fig. 2 and then setting the location, depth and angle of the implant, thereby resolving the stress arising from the manufacturing and attachment of prosthetics. In the event of not using Digital Guided Surgery, there occasionally is accompanying concern for production, attachment and prolonged use of implant prosthetics due to the unintended results of implant embedding.

3) Shorten time taken for the procedure
Although it needs approximately 1 week additionally for the production of guide in addition to the diagnosis process for implant procedure, it can be easily accommodated by the patient through provision of sufficient explanations and information on the advantages thereof. It is possible to substantially shorten the time take for the implant procedure simply by omitting the suture process, which takes up the longest time in ordinary implant cases, to certain extent.

4) Increase the satisfaction of the patients
Most importantly, there is no reason to reject it from the viewpoint of the surgeon since the level of consent as well as satisfaction of the patient is high. In general, procedure is conducted with minimal incision, there is substantially less bleeding and swelling, thereby resulting in quicker recovery that leads to high level of satisfaction by the patients.

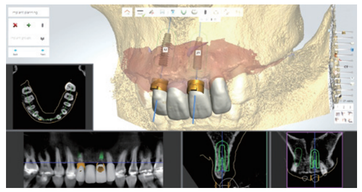

Fig. 2 It is possible to set the position of the implant after having set the prosthetics under Planning Software

[Flapless Surgery]
There had been extensively conflicting opinions on Flap and Flapless surgeries. I believe it is meaningless to try to discern whether these opinions are correct or not since they are based on facts confirmed through experiments by researchers and experiences of clinical surgeons. In fact, I do not prefer Flapless surgery and prefer to execute embedding after having personally checked the bone conditions in most cases. However, it is determined that advantages of Flapless Surgery can be applied usefully in clinical settings since the Digital Guided Surgery in general is conducted in Flapless Surgery format.

1) Prevention of bone absorption
Through various experiments and researches, it has been reported that Flapless Surgery can prevent natural bone absorption. According to Wilderman N. et al., there was absorption of prescribed quantity of marginal bones (average of 0.5mm) after full thickness flap surgery if the Flap is opened. In addition, it reported that there was no such bone absorption in the case of Flapless Surgery, in which the flap was not opened (Fig. 3).

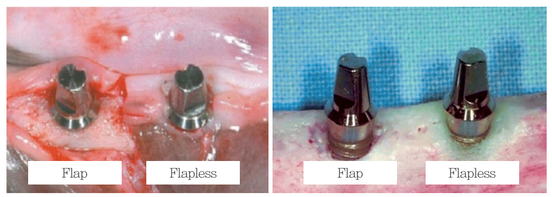

Fig. 3 Absorption of marginal bones after Flap Surgery (left) and Flapless Surgery (right)(animal experiment by professors Byeong-ho Choi and Seung-mi Jeong of Wonju Severance Hospital)

2) Prevention of inflammation around the implant
As the results of histological and clinical examination of the healed surrounding tissues after the implant surgery, it was foreseen that there would be high resistance against inflammation around the implant following healing since deep pockets are not formed in the Flapless Surgery executed without opening the flap (Fig. 4 Professors Byeong-ho Choi and Seung-mi Jeong of Wonju Severance Hospital)

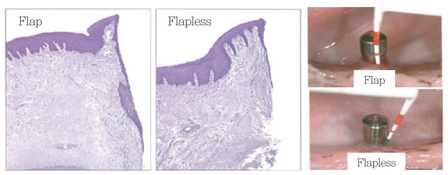

Fig. 4 Findings of healed soft tissues and depth of the probe pin after Flapless Surgery (above)

It is possible to increase the success rate of implant if embedding of implant that can be predicted through Digital Guided Surgery and if quick osseointegration is accompanied most importantly in immediate restoration cases. Therefore, since diameter and length, etc. of the implant to be embedded have already been decided through analysis prior to the surgery in the Digital Guided Surgery cases, assertive utilization of UV irradiated implant is required as it is possible to reduce the time spent by irradiating the necessary implant with UV ray in advance in time for the surgical time.

[Case]]
A 47-year old male patient without particular past history of diseases visited our hospital with the desire to use fixation type prosthetics by using implant instead of the dentures he has been using. It was planned that among the 5 existing residual teeth, namely, #14, 33, 32, 31 and 43, only #33 and 43 will be left intact with the rest to be extracted along with full mouth rehabilitation for both mandibular and maxillary aspects (Fig. 5)

Fig. 5 Panoramic view at the time of initial examination

Full arch was embedded along with augmentation of the maxillary cavity for the maxillary aspect (Fig. 6) while for the mandibular aspect, surgery was executed after having confirmed the location of embedding and type of implant by executing Digital Guided Surgery analysis (Fig. 7-1 ~ 7-5).

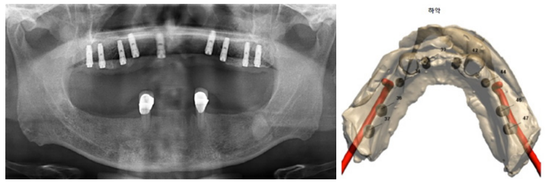

Fig. 6 Panoramic view after the both sinus B.G and 1st maxillary embedding

Information on the implant			
Implant position(FDI)	32	34	36
Manufacturer	DIO	DIO	DIO
Types	UF(II) 3811	UF(II) 4011	UF(II) 5011
Order No.	UF(II) 3811	UF(II) 4011	UF(II) 5011
Length, mm	11.5	11.5	11.5
Diameter(Ø), mm	3.8	4	5
Color	Blue	Red	Green

Information on the implant			
Implant position(FDI)	37	42	44
Manufacturer	DIO	DIO	DIO
Types	UF(II) 5011	UF(II) 4011	UF(II) 4011
Order No.	UF(II) 5011	UF(II) 4011	UF(II) 4011
Length, mm	11.5	11.5	11.5
Diameter(Ø), mm	5	4	4
Color	Green	Red	Red

Fig. 7-1 Digital Guide analysis data

Information on the implant	
Implant position(FDI)	34
Manufacturer	DIO
Types	UF(II) 4011
Order No.	UF(II) 4011
Length, mm	11.5
Diameter (Ø), mm	4
Color	Red
Safe domain-dental root side distance	2.0
Safe domain-radiant distance	1.5

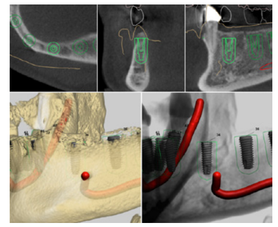

Fig. 7-2 Digital Guide analysis data

Fig. 7-2 Panoramic view after mandibular digital guided surgery

Surgery was conducted for the maxillary aspect after flap elevation due to the issue of bone graft while flapless digital guided surgery was conducted for mandibular aspect. DIO-UV implant was irradiated with UV ray (15 minutes) 20 minutes ahead of the surgery for use (Fig. 8-1 and 8-2).

Fig. 8-1 UV Light irradiator

Fig. 8-2 UV implant

Since there was no particular complication after the procedure, 8th week prosthetics was executed on the basis of the procedure executed for the mandibular aspect and final maxillomandibular prosthetics were completed (Fig. 9-1 and 9-2). In comparison to the general SLA surface implant, the final prosthetics were set about 1 month earlier.

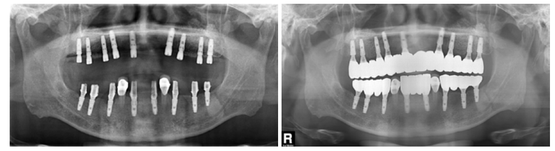

Fig. 9-1 Panoramic view at the state of execution of prosthetics
Fig. 9-1 Panoramic view after the final prosthetics

SLA surface that had been recognized as the most stable and verified implant surface processing method until recently also has certain limitations. The clinical surgeons have the view that these are the innate nature and characteristics of SLA surface processing rather than as limitations of SLA processed surfaces. In conclusion, SLA surface processing is capable of inducing substantially more bio-friendly and quicker osseointegration than how it is felt in clinical setting. However, its functions are simply degraded due to the attachment of organic matters such as hydrocarbon, etc. that interfere with osseointegration onto the implant surface with passage of prescribed period of time after the initial processing of titanium (some products are being distributed by being immersed in solution to prevent contact between the implant surface and air after the processing of titanium). Therefore, it is possible to induce the outstanding bio-friendly properties of SLA surface processing by removing the organic matters attached onto the implant surface immediately prior to the embedding of the implant. Photofunctinalization through UV irradiation is the method used for this purpose. Through this, it would be possible to optimize the original functions of the SLA processed surface including shortening of the time taken for osseointegration healing, fortification of resistance against inflammation around the implant, and improvement of success rate of implant for difficult cases with aged bone or inadequate area of bone contact with implant in the early stage.