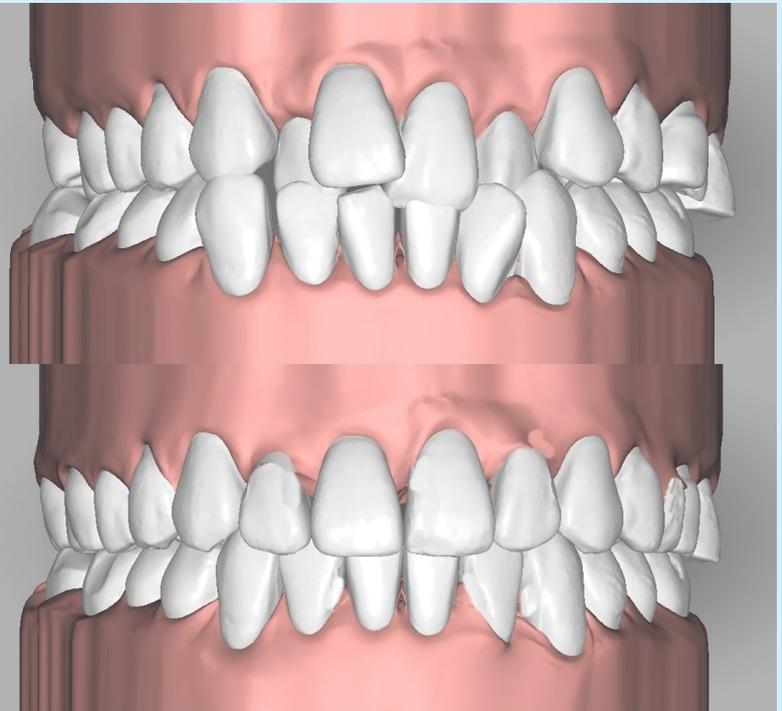
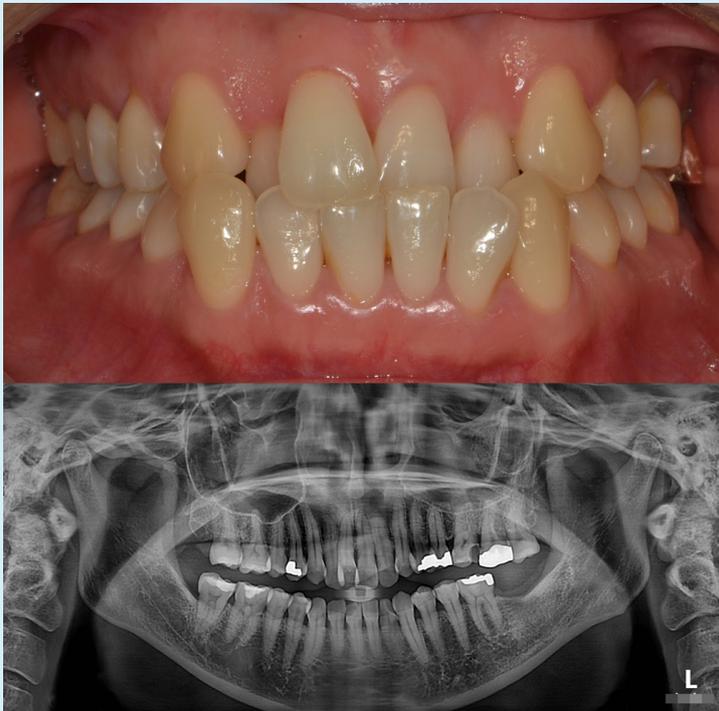
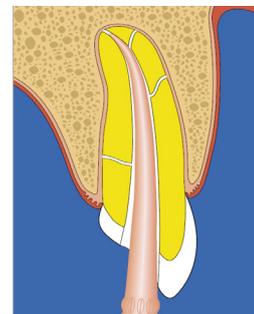
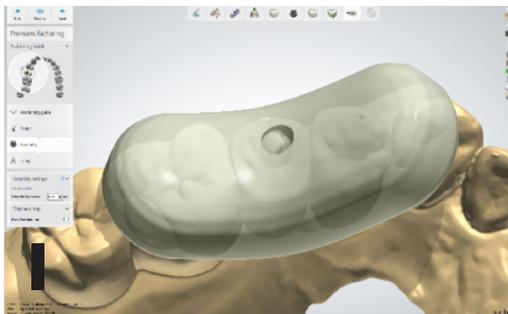


# JCDD

Journal of Clinical & Digital Dentistry





**TABLE OF CONTENTS**

About the Journal 2-3

Editorial 4  
Wongun Chang

Fabrication of custom abutment using stock abutment for non-hex fixtures:A Case Report 6-12  
Jongmok Han

Serafin:A Superior System in Clear Aligner Technology 14-21  
Dohoon Kim

Frequently Asked Questions on Endodontics 23-30  
Kiyoun Yoo

## 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

### Editor-in-chief

Wongun Chang (Milestones Dental Institute, Seoul, Republic of Korea)

### Deputy Editor

Dongwoon Lee (Dept. of Periodontology, Veterans Health Service Medical Center, Seoul, Republic of Korea)

Kwantae Noh (Dept. of Prosthodontics, School of Dentistry, Kyung Hee University, Seoul, Republic of Korea)

### Editorial Board

Pil Lim (NY Pil Dental Office, Incheon, Republic of Korea)

Chulwan Park (Boston Wahn Dental Clinic, Seongnam, Republic of Korea)

Dohoon Kim (Seoul N Dental Clinic, Seongnam, Republic of Korea)

Yongkwan Choi (LA Dental Clinic, Seoul, Republic of Korea)

Hyundong Kim (Seoul Smart Dental Clinic, Seoul, Republic of Korea)

### Reviewing Board

Unbong Baik (Smile-with Orthodontic clinic, Seoul, Republic of Korea)

Aaron Seokhwan Cho (Dept. of Restorative Sciences, College of Dentistry, Texas A&M University, Texas, USA)

Jiman Park (Dept. of Prosthodontics, School of Dentistry, Seoul National University, Seoul, Republic of Korea)



# Editorial

## Changing does not mean developing

Everything changes over time. Some develop through change, while others do not develop and only change.

In the past, complete denture was an answer to restore teeth in edentulous patients. Currently, dental implants allow patients to have teeth similar to natural dentition. We can say it is changing and developing. Recently, zirconia restorations have become very popular instead of gold restoration. It is simply changing because regardless of the materials used, the treatment goal remains the same. Many orthodontic treatment mechanics have been developed and used for more than 100 years since Dr. Angle said that the establishment of normal occlusion is the highest aim of orthodontists; however, to date, the goal of orthodontic treatment has not changed. Orthodontics is changing but not developing.

Recently, with the increasing use of digital technology in dentistry, many changes are equally occurring in orthodontics. In addition, the SERAFIN clear aligner system based on computer-aided engineering aims for a different goal which is the establishment of functional occlusal harmony. The SERAFIN system aspires to develop the field of orthodontics by changing the goal of orthodontic treatment, which has not changed for more than 100 years.

In this issue of JCDD, there is an article introducing the SERAFIN clear aligner system, a FAQ-style article on endodontics, and an article regarding custom abutment design using computer-aided design software. These are valuable not only to dentists but also to dental technicians.

I am very proud that JCDD plays a role in changing and developing the field of dentistry.

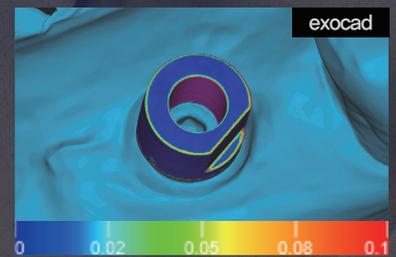
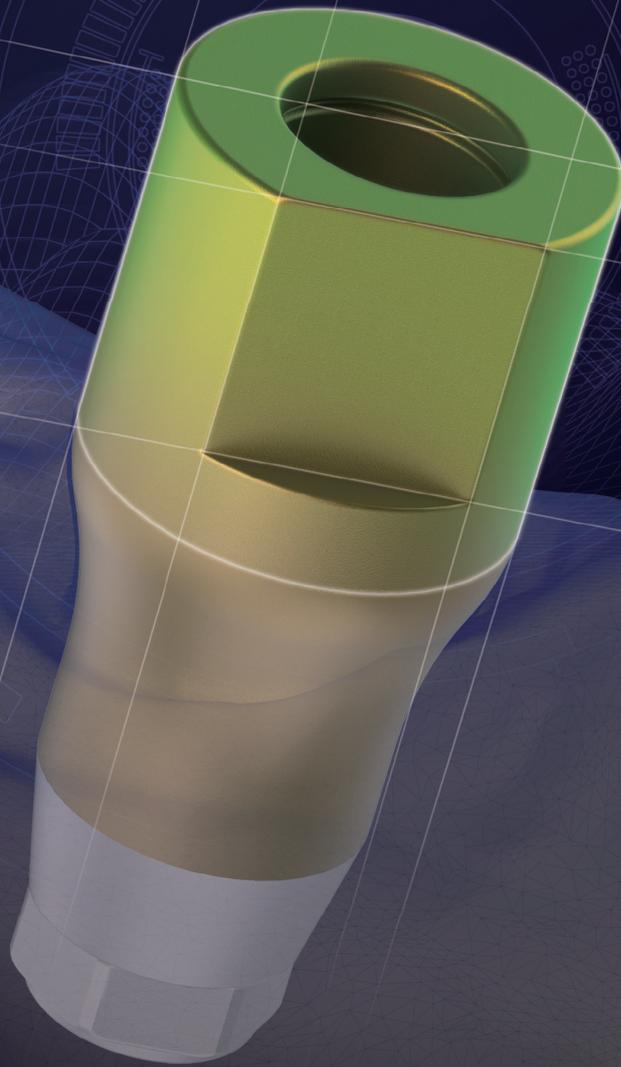


A handwritten signature in black ink, appearing to read 'Wongun Chang' in a stylized, cursive script.

Wongun Chang, DDS MS PhD

# DENTIS ScanBody

**Remarkable Accuracy!**



스캔데이터와 라이브러리가 일치하는 모습  
(순수한 정합으로 보철물의 정확도 향상)

# Fabrication of custom abutment using stock abutment for non-hex fixtures: A Case Report

Jongmok Han, DDS

## Abstract

The use of a scanbody is essential for the fabrication of implant prostheses with custom abutments using an intraoral scanner. However, in the absence of a non-hex scanbody, a conventional scanbody cannot be used for the placement of non-hex fixtures. To address this limitation, the library provided by the manufacturer was modified, so that it could be used as a scanbody. Subsequently, a custom abutment was fabricated according to the routine method using an intraoral scanner, and a jig with zirconia was used to position it accurately.

## Introduction

The method of implant prosthesis fabrication can be classified as using stock or custom abutments. Stock abutment has advantages in terms of simplicity in use and cost, but it has limitations in forming various shapes of the prosthesis.

With the use of a custom abutment, various shapes of the prosthesis can be freely designed; in particular, it has the advantage of freely determining the path of insertion of the prosthesis when the implant is not placed in parallel.<sup>1,2,3</sup> By connecting the scanbody to the implant and scanning using an intraoral scanner, the prosthesis can be fabricated in various shapes through a dental CAD program without having to use a model.

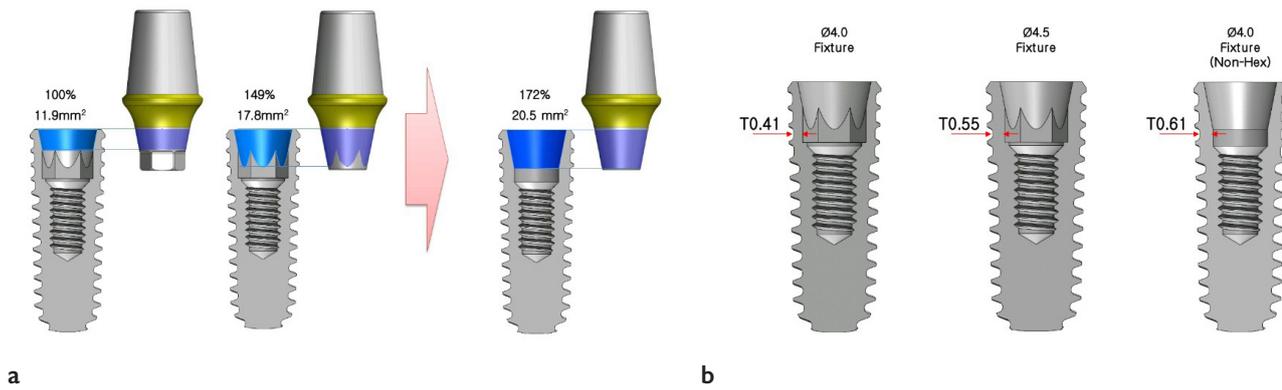
### Non-Hex Fixture

In recent years, non-hex fixtures have been employed for reasons such as fewer cases of fractures. Non-hex fixtures have a wider contact area with the abutment than commonly used hex fixtures and have thicker walls when comparing fixtures with the same diameter. Even a non-hex fixture with a diameter of 4.0 mm has thicker walls than a hex fixture with 4.5 mm diameter. With these characteristics of the non-hex fixtures, even for cases of tricky placement due to narrow bone width, the problem can be resolved by placing a fixture with a small diameter without additional bone grafting.<sup>4</sup> Furthermore, owing to the increase in wall thickness, fewer cases of fractures are expected (Fig. 1a-b).



### Jongmok Han

- Hana Dental Clinic
- DDS, Chonbuk National University
- Diplomates of Korean Advanced General Dentistry
- Clinical Adjunct Professor, School of Dentistry, Chonbuk National University
- Member, Scientific Affairs of Korean Dental Association
- Director, Korean Academy of Digital Dentistry
- Author of Digital Dentistry of Korea Journal Clinical Dentistry Magazine (2019-2020)
- Speaker of Digital Dentistry of DentalBean



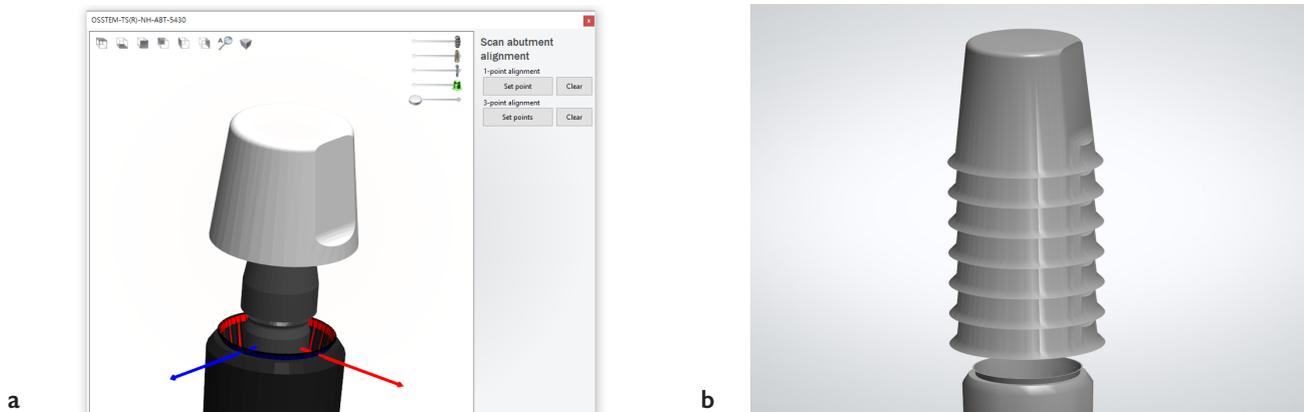
**Fig. 1a-b.** (a) Comparison of contact area between non-hex fixtures and hex fixtures fixture  
(b) Comparison of wall thickness of non-hex fixtures and hex fixtures

**Non-Hex Scanbody**

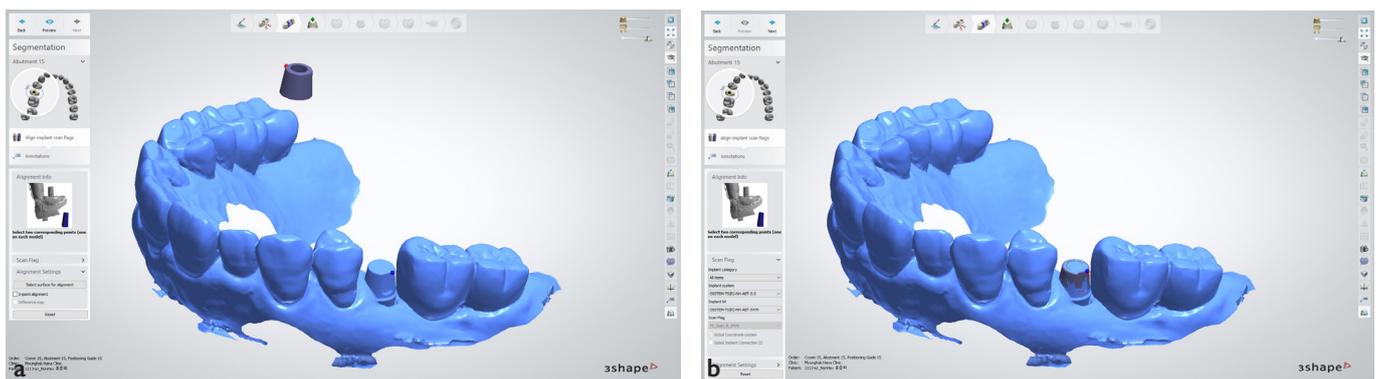
Although the non-hex fixture has many advantages, as described above, there is no non-hex scanbody available for the fabrication of custom abutments. However, by modifying the library, registering the non-hex stock abutment as a scanbody, connecting to the implant, and scanning with an intraoral scanner, the custom abutment, and then the prosthesis can be fabricated (Fig. 2a-b).<sup>5,6</sup>

A non-hex stock abutment with a diameter of 5.0 mm and a height of 4.0 mm, which is similar in size to the conventional scanbody, was decided to be used as the scanbody, and registered as a scanbody up to the gingival height. By modifying the library in this way, the stock abutment is detected as a scanbody (Fig. 3a-b).

When the prepared stock abutment is connected to the implant, intraoral scanning can be performed in the same way as when using a conventional scanbody, and the subsequent process is exactly the same as when using a conventional scanbody.<sup>7</sup>



**Fig. 2a-b.** Modified implant library, Registration of the non-hex stock abutment as scanbody up to the gingival height

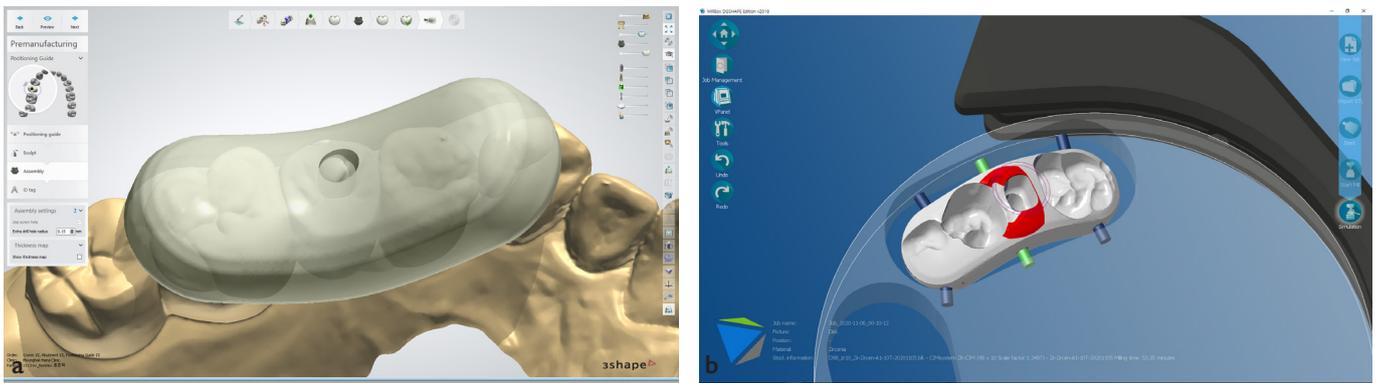


**Fig. 3a-b.** Stock abutment detected as the scanbody

### Non-Hex Custom Abutment

Because the abutment is used for non-hex fixtures, the custom abutment is also fabricated as a non-hex abutment. In this case, a jig is required to fix the custom abutment at the desired position.<sup>8</sup> However, because the conventional method of using pattern resins requires a model and cannot be used for fabrication without a model<sup>9,10</sup>, and a jig fabricated by 3D printing, frequently used in the fabrication without a model, tends to be weak in strength and may lead to fracture when tightening the screw; in addition, deformation can occur during the fabrication process, and accurately reproducing the position is challenging in the case of non-hex abutment.<sup>11</sup>

Therefore, a jig with robust strength and capable of accurately reproducing the position is required, and the jig is fabricated using zirconia to address the requirements (**Fig. 4a-b**). Using the fabricated jig, the non-hex custom abutment was placed at the desired position, the screw was tightened with the torque recommended by the manufacturer, and the final prosthesis was attached.



**Fig. 4a-b.** Fabrication process with designing of positioning jig and milling with zirconia

## Case Report

### Case I

The patient was a 56-year-old woman, and a treatment plan was established to extract her tooth #15 first due to periodontal problems and then to place the implant.

A non-hex fixture of Osstem Implant with a diameter of 4.0 mm and a length of 10 mm was used for placement of the implant, and subsequently, the custom abutment was used to fabricate the final prosthesis (**Fig. 5-11**).



**Fig. 5.** Initial examination



**Fig. 6.** Placement of non-hex implant at position #15

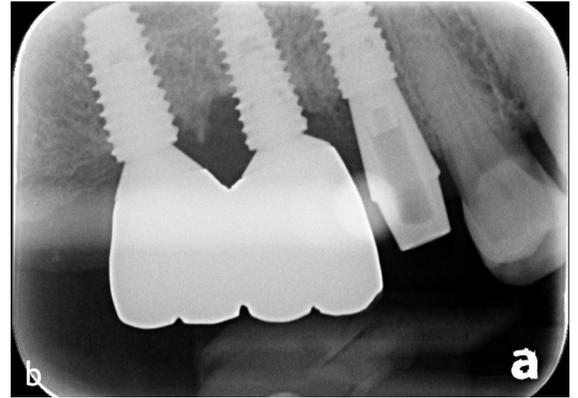


Fig. 7a-b. Connection of the non-hex stock abutment to be used as a scanbody



Fig. 8a-b. Non-hex custom abutment and jig with zirconia

Fig. 9. Insertion of the jig with zirconia

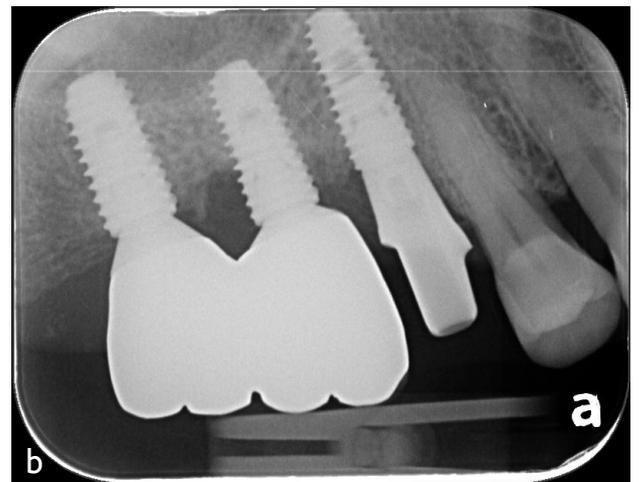


Fig. 10a-b. Connection of custom abutment



Fig. 11a-b. Attachment of final prosthesis

**Case 2**

The patient was a 66-year-old man, and a treatment plan was established to extract teeth #21, 22, 23, 24 first due to dental caries and periodontal problems, followed by placement of the implant.

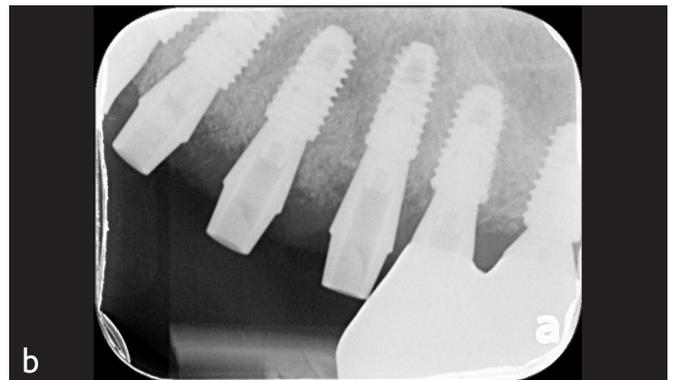
A non-hex fixture of Osstem Implant with a diameter of 4.0 mm and a length of 8.5 mm was used for tooth #21, and the fixture with a diameter of 4.5 mm and a length of 8.5 mm was used for tooth #23, 24. A stock abutment was then used to fabricate the interim prosthesis. Subsequently, a custom abutment was used to fabricate the final prosthesis (Fig. 12-18).



**Fig. 12.** Initial examination: Treatment plan to extract the left maxillary anterior teeth and place the implants



**Fig. 13.** Placing non-hex implants at position #21, 23, 24 and fabricating interim prosthesis using stock abutment



**Fig. 14a-b.** Connection of the non-hex stock abutment to be used as a scanbody



**Fig. 15.** Non-hex custom abutment and jig with zirconia



**Fig. 16.** Insertion of the jig with zirconia

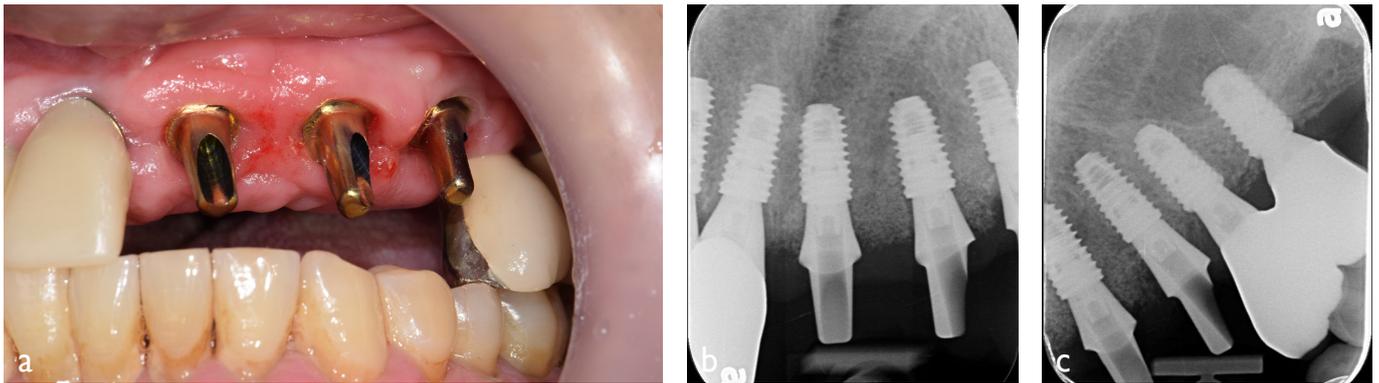


Fig. 17a-c. Connection of custom abutment

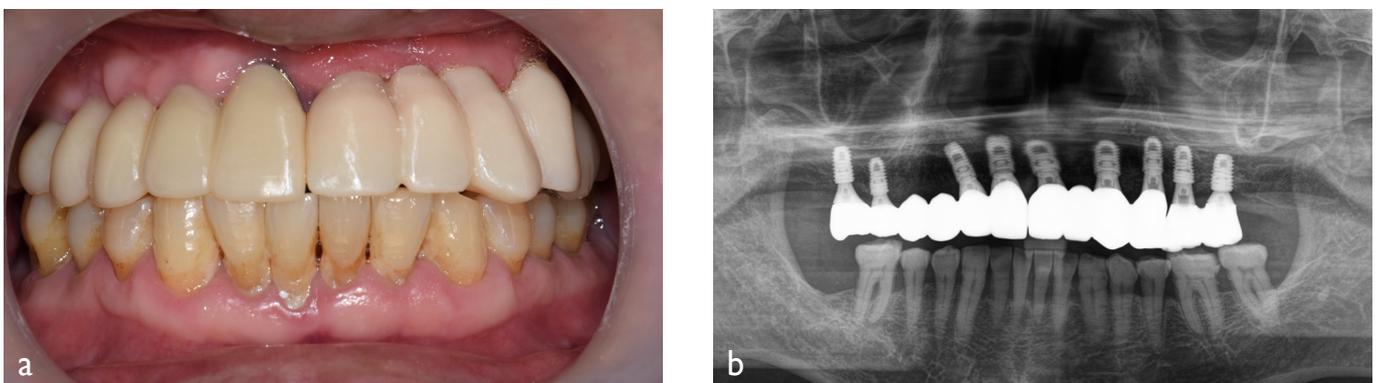


Fig 18a-b. Attachment of final prosthesis

## Discussion

When using a non-hex fixture, the prosthesis is fabricated with a non-hex abutment. For stock abutments, impression taking or scanning is performed at the abutment level<sup>12</sup>, whereas when using a custom abutment, impression taking or a scanbody is used at the fixture level<sup>13</sup>. However, if there is no non-hex scanbody provided by the manufacturer, it can cause difficulties in the fabrication of custom abutments. To address this limitation, the library was modified to use the non-hex stock abutment as a scanbody.

When fabricating a prosthesis without a model using an intraoral scanner, it is common to use a jig printed from a 3D printer; and this can be used without any problem when using a hex abutment. However, a more accurate positioning method is required when using a non-hex abutment. To this end, a jig with zirconia was used, and results without clinical problems were obtained.

## Reference

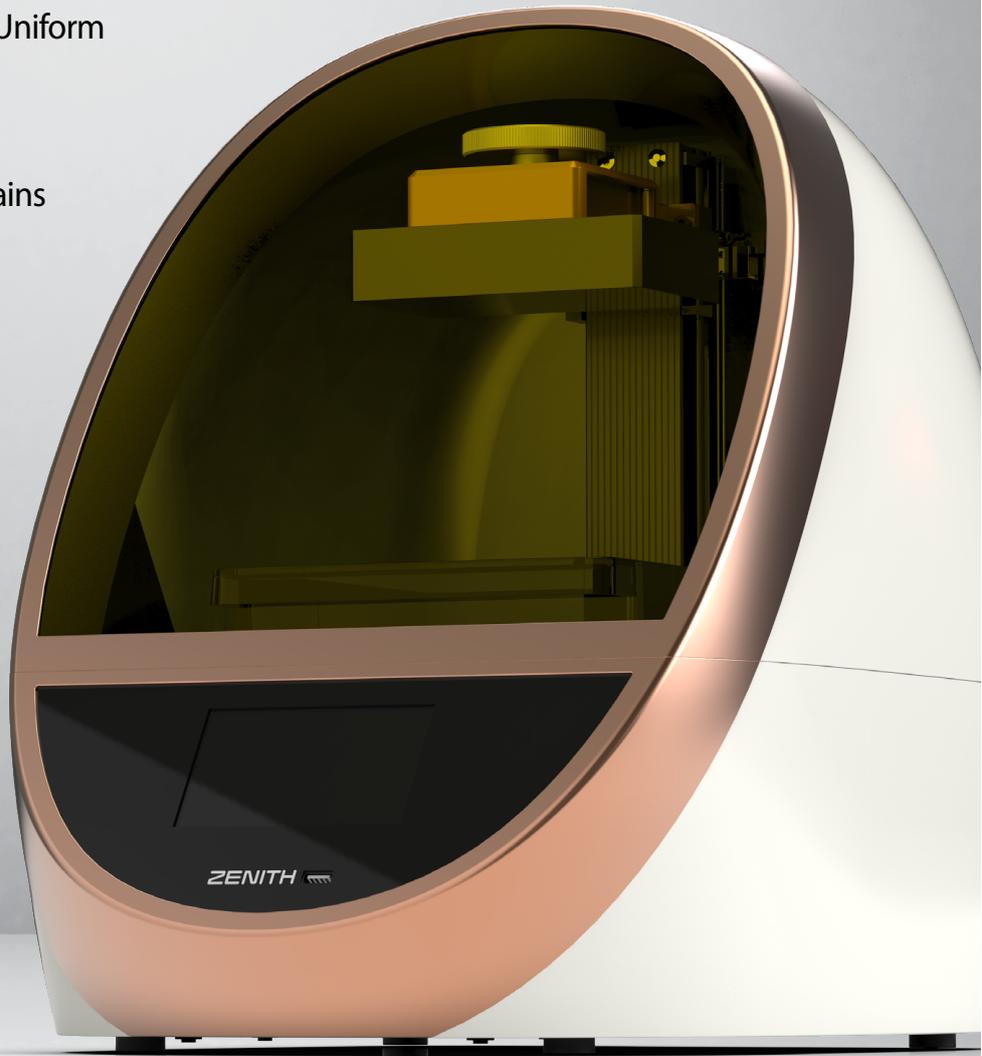
1. Sailer I, Zembic A, Jung RE, et al. Randomized controlled clinical trial of customized zirconia and titanium implant abutments for canine and posterior single-tooth implant reconstructions: preliminary results at 1 year of function. *Clin Oral Implants Res.* 2009;20:219-25.
2. Wu T, Liao W, Dai N, Tang C. Design of a custom angled abutment for dental implants using computer-aided design and nonlinear finite element analysis. *J Biomech.* 2010;43:1941-6.
3. Abichandani, Sagar & Kavlekar, Abhishek S & Nadiger, Ramesh. (2013). Abutment selection, designing, and its influence on the emergence profile: A comprehensive review. *European Journal of Prosthodontics.* 1. 1. 10.4103/2347-4610.116586.
4. Warreth, Abdulhadi & Ibeyou, Najia & O'Leary, Ronan & Cremonese, Matteo & Abdulrahim, Mohammed. (2017). Dental implants: An overview. *Dental Update.* 44. 596-620. 10.12968/denu.2017.44.7.596.
5. Zhang, J., Zhang, R., Ren, G., & Zhang, X. (2017). A method for using solid modeling CAD software to create an implant library for the fabrication of a custom abutment. *The Journal of prosthetic dentistry,* 117 2, 209-213.
6. Lin WS, Harris BT, Morton D. The use of a scannable impression coping and digital impression technique to fabricate a customized anatomic abutment and zirconia restoration in the esthetic zone. *J Prosthet Dent* 2013;109: 187-91.
7. Mizumoto RM, Yilmaz B. Intraoral scan bodies in implant dentistry: A systematic review. *J Prosthet Dent.* 2018 Sep;120(3):343-352. doi: 10.1016/j.prosdent.2017.10.029. Epub 2018 Apr 5. PMID: 29627211.
8. Wu YL, Wu AY. A method of fabricating an accurate repositioning device for relocating multiple multiunit abutments. *J Prosthet Dent.* 2017 Oct;118(4):564-566. doi: 10.1016/j.prosdent.2017.01.009. Epub 2017 Apr 21. PMID: 28434683.
9. Jacobson Z, Peterson T, Kim WD. Positioning jig for implant abutments: procedures and clinical applications. *J Prosthet Dent.* 1996 Apr;75(4):435-9. doi: 10.1016/s0022-3913(96)90038-4. PMID: 8642532.
10. Judy KW. The abutment seating jig: a prosthodontic implant adjunct. *Implant Dent.* 1997 Spring;6(1):14-6. doi: 10.1097/00008505-199700610-00003. PMID: 9206400.
11. Altoman, Majed & Alqarni, Hatem & Alfaifi, Mohammed & Kattadiyil, Mathew. (2021). Digital Fabrication of a Repositioning Jig for Multiunit Abutments Placement: A Dental Technique. *International Journal of Prosthodontics and Restorative Dentistry.* 11. 10.5005/jp-journals-10019-1288.
12. Kim JE, Park JH, Moon HS, Shim JS. Simplified digital workflow for dental implant restoration on a stock abutment using an intraoral scanner: A dental technique. *J Prosthet Dent.* 2017 Sep;118(3):268-272. doi: 10.1016/j.prosdent.2016.10.025. Epub 2017 Feb 20. PMID: 28222883.
13. Ramsey CD, Ritter RG. Utilization of digital technologies for fabrication of definitive implant-supported restorations. *J Esthet Restor Dent* 2012;24: 299-308.

**How to cite this article:** Han JM. Fabrication of custom abutment using stock abutment for non-hex fixtures: A Case Report. *J Clin Digit Dent.* 2021;3(3):6-12. [www.jcdd.org](http://www.jcdd.org)

The New Paradigm of 3D Printer

# ZENITH

- DLP LED Light System That Enables Uniform Printing
- High-resolution Printing System
- A Self-heated Resin Tank That Maintains A Constant Internal Temperature
- Innovative and Stylish Design
- Ideal Application to Various Areas



GOOD DESIGN  
산업통상자원부선정



red dot  
award



WORLD  
CLASS  
PRODUCT  
OF KOREA  
1  
세계 일류 상품



Surgical Guide



Dental Model



Temporary



Cast coping &  
Partial Frame



Bite Tray



Splint



IDB Tray

COMING SOON

Implant the Smile  
**DENTIS**

Head Office (Korea)

Tel +82 53 589 3528 E-mail colin@dentis.co.kr Web-site www.zenith3d.co.kr/eng

# Serafin: A Superior System in Clear Aligner Technology

Dohoon Kim, DDS, MSD

## Introduction

It is the era of clear aligners now. Clear aligner orthodontics, which was once neglected by orthodontists, occupies an important position in the dental profession, shown by its rising value in the stock market. Currently, the world's No. 1 company accounts for a significant portion of the global clear aligner orthodontic market, but many latecomers follow, including the Serafin clear aligner system (Fig. 1).

Clear aligners have increased in popularity as they have improved access to orthodontic treatment. While application of clear aligners cannot be attempted blindly without basic knowledge of orthodontics, they have improved accessibility as they are free from the tools and materials, maintenance, and inventory management of the equipment necessary for traditional orthodontic treatment. Let us consider the other advantages of clear aligner orthodontics.

### I. Advantages in Oral Hygiene

In general bracket orthodontics, patients cannot use dental floss during the treatment period, and special instruments are required to keep the oral cavity clean because of the brackets and wires. However, in clear aligner orthodontic treatment, standard oral hygiene methods can be used. Therefore, clear aligners can be a good option for adult patients who may be at a periodontal disadvantage during orthodontic treatment. When treating a patient with a long clinical crown due to poor periodontal support, brackets need to be attached to the cervical region because the center of resistance moves to the apex, which makes periodontal care more difficult. In contrast, clear aligner orthodontics do not interfere with periodontal care.



Fig. 1. Clinical photo of a patient wearing the Serafin clear aligner system.



### Dohoon Kim

Dr. Dohoon Kim graduated from Seoul National University College of Dentistry (SNUCD) and also he acquired master's degree at SNUCD, and completed doctor's degree course in alma mater. He completed a postgraduate residency at Seoul Central Paik hospital in Seoul, Korea, and completed Advanced Specialty Program in Orthodontics at New York University, and completed advanced program on TMD and Orofacial pain at University of Kentucky. He contributes Serafin clear aligner system as consultant and is running private practice (Seoul N dental clinic) in Seongnam, Republic of Korea.

## 2. Optimal for Adult Orthodontics with Many Prostheses

In the past, orthodontic treatment was regarded as an exclusive domain of children, adolescents, or patients in their early twenties. Recently, orthodontic treatment has increased in patients over 30 years of age, and has also been implemented in patients in need of comprehensive prosthetic treatment (Fig. 2).

In some cases, it is difficult to position or attach orthodontic brackets to a tooth put over by a dental crown. With clear aligner orthodontics, existing prosthesis is not a problem and can sometimes assist its usage, but with orthodontic brackets it presents as more of a challenge (Fig. 3).

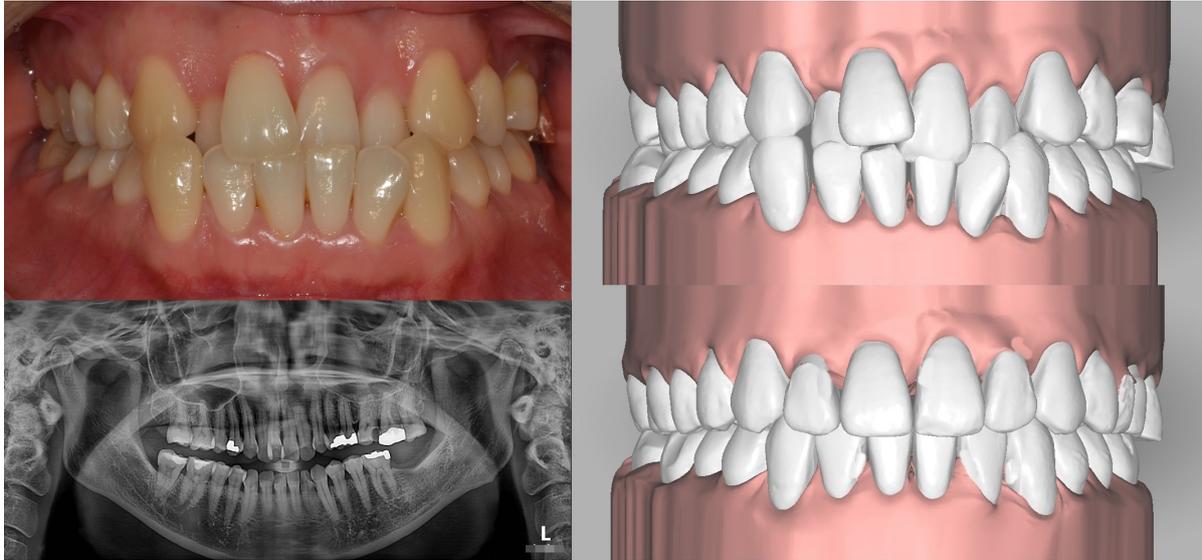


Fig. 2. A patient using the Serafin clear aligner system, who was reluctant to get conventional braces.

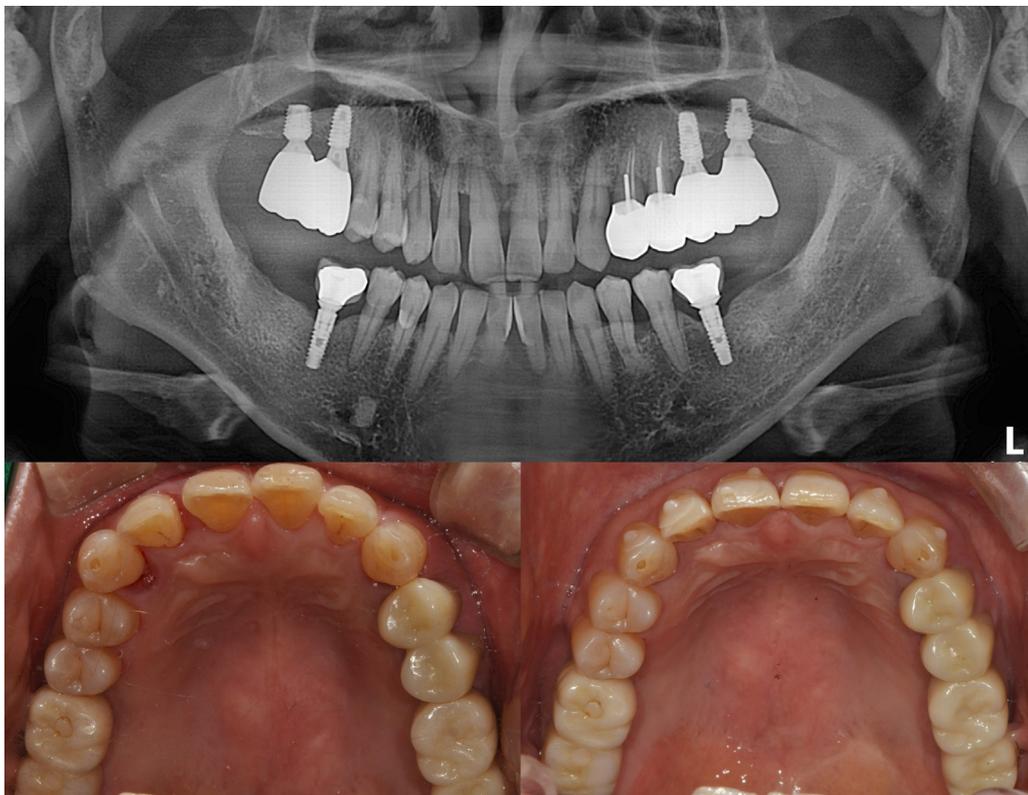


Fig. 3. A patient using the Serafin clear aligner system after 2 months. He has multiple implant prostheses and splinted full zirconia crowns.

### 3. Optimized for Target Tooth Movement

Clear aligners are optimal for partial correction—target tooth movement—compared to general bracket orthodontics. In general bracket orthodontic treatment, passive bonding is required to move only certain teeth while ensuring that the rest are immobile. However, clear aligners can serve as a solid anchor for partial correction. Among adult patients, orthodontic treatment is recommended in those who have anterior crowding or spacing, but there are many cases of hesitation concerning the cost of the orthodontic treatment or appearance. Clear aligner orthodontics can be the perfect treatment option for these patients.

In the case of treatment using a traditional straight wire appliance (SWA), space closure is performed after leveling and alignment in the first stage. However, while performing target tooth movement in the anterior region using clear aligners, the leveling and alignment process can be skipped because it does not change the occlusion of the posterior region, thereby requiring a shorter treatment period. It also has the advantage of being invisible and removable in social settings (**Fig. 4**).



**Fig. 4.** Anterior spacing closed after wearing 10 sets of the Serafin clear aligner system.

If the orthodontic treatment is already completed and there happens a partial relapse, the patient will likely prefer to receive treatment without attaching a bracket device. Many patients want to get the upper and lower six incisors fixed in these cases, there is no need to change the occlusion of the posterior teeth (**Fig. 5**).

Partial correction cases resolved by clear aligner system will satisfy both dentists and patients. In cases requiring the movement of canine teeth, a tube-type orthodontic device is difficult to affix due to the lack of anchorage, and although it is relatively difficult to see, a wire should be used instead. However, in clear aligner system, these appliances are not required.



**Fig. 5.** A patient on treatment to correct orthodontic relapse without conventional braces.

#### 4. Biomechanical Advantage

In general, clear aligner system has more limitations in tooth movement than general bracket orthodontics, but there are cases where it is favorable, such as those involving spacing, expanding the arch, and moving the posterior teeth backward. Since the initial leveling and alignment of the SWA device is skipped, the resolution of spacing and arch expansion can be obtained in a shorter timeframe.

Cases involving backward movement of the posterior teeth present biomechanical difficulty with normal bracket orthodontic treatment; however, it is relatively easy to accomplish with clear aligners (**Fig. 6**). The posterior movement of the maxillary molars can be a surprisingly fast and efficient way to solve the case of Class II division 2 malocclusion without tooth extraction.



**Fig. 6.** Successful ongoing distalization of posterior teeth after wearing 10 sets of Serafin clear aligners in comparison with the planned SERAview image

## 5. Optimized for Telemedicine in the Absence of Emergencies

In conventional bracket orthodontics the bracket device may fall off, or the wire may poke the oral mucosa. These situations are usually difficult to predict, and if they do occur, they become an emergency. Since orthodontic treatment does not require frequent visits, patients often live far from the dental office. If a patient requires an immediate resolution, distance can become a barrier for emergency care, especially as it is not easy to refer to another dentist. Even in a situation where a patient lives only a short distance away from the dental office, it may be difficult to provide emergency treatment while treating other patients.

So far, we have looked at the characteristics of general clear aligner orthodontics. Now, we will discuss the features of Serafin clear aligner system compared with other clear aligner orthodontic systems.

### 1. Characteristics of the Material

Early clear aligners were made of a single layer material, polyethylene terephthalate (PET). Although PET has flexibility and a certain rigidity, there have been cases where excessive force was applied, or permanent deformation occurred.

Excessive force causes patient discomfort, and permanent deformation can traumatize the oral tissue or interfere with desired tooth movement. Recently, the material has been innovated from a monolayer to a multilayer in order to apply a light continuous force. Serafin clear aligner orthodontic treatment uses a triple layer, which gives it rigidity while applying a light continuous force to tooth. This contributes to the success of treatment by minimizing the tracking error, a common problem with clear aligners, and offers protection to patients with bruxism.

In addition, the material of Serafin clear aligner system has excellent resistance to staining. In principle, it is recommended to remove the clear aligner orthodontic device from the mouth when drinking beverages other than water.

However, sugar-free beverages can be consumed without removing the device. Some materials are vulnerable to staining, and the Serafin clear aligner has an advantage in this aspect.

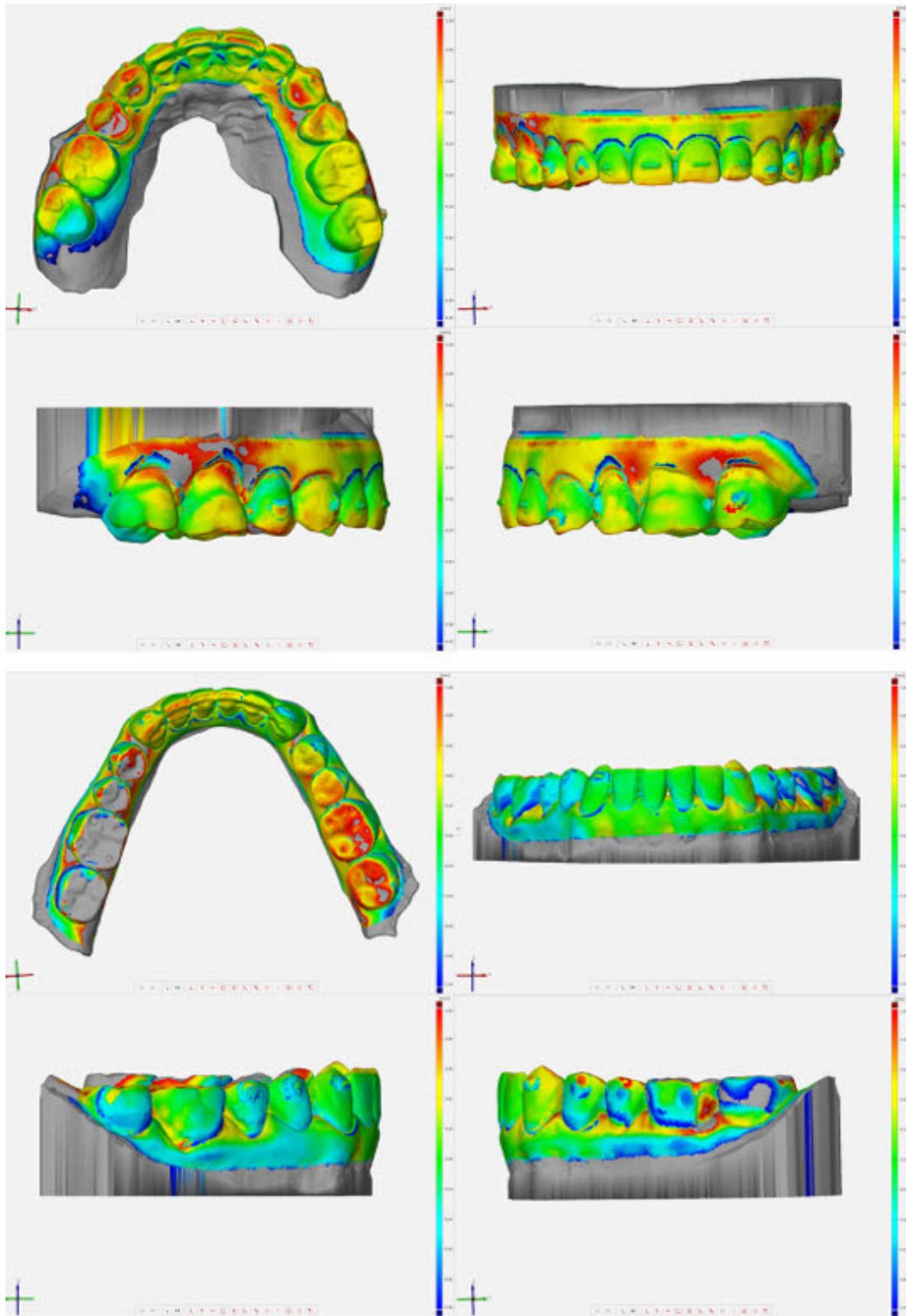
A misplaced wire can be taken care of by cutting the wire, but it takes a considerable amount of time if the bracket device falls off. Such emergencies rarely occur with clear aligner orthodontics.

Even when the clear aligner orthodontic device is broken and deformed, it is possible to prevent the situation from worsening by wearing the clear aligner for the previous step. Therefore, even patients who require extensive lag time between visits, due to enlisting in military service or studying abroad, can be treated with relative ease.

### 2. Disbursement

Although there are clear aligner devices that are delivered all at once from the first step to the final step, Serafin clear aligners can be dispensed all at once or in units of 20.

Thus, Serafin clear aligner system minimizes tracking errors (**Fig. 7**), and reduces discomfort associated with the multiple attachments required in complex tooth movement because we can place many attachments step by step. In addition, when it is necessary to modify the shape or position of the attachment, it can be actively replaced. Serafin clear aligner system also prevents resource waste and environmental pollution that occurs when an additional refinement device is manufactured because of a tracking error.



**Fig. 7.** Color-coded assessment of the accordance between real tooth movement and planned teeth movement on the SERAview platform to minimize tracking errors after wearing 20 sets of Serafin clear aligners.

### 3. Web-based Communication

The SERAview platform, which enables smooth communication between the manufacturer and the dentist, is accessible on mobile phones, tablets, and computers through SERAview Web (Fig. 8). This enables faster communication and decision-making, thereby reducing the device manufacturing period. If the manufacturer responds to a question during the communication process, the doctor is notified through a text message, making immediate confirmation possible.

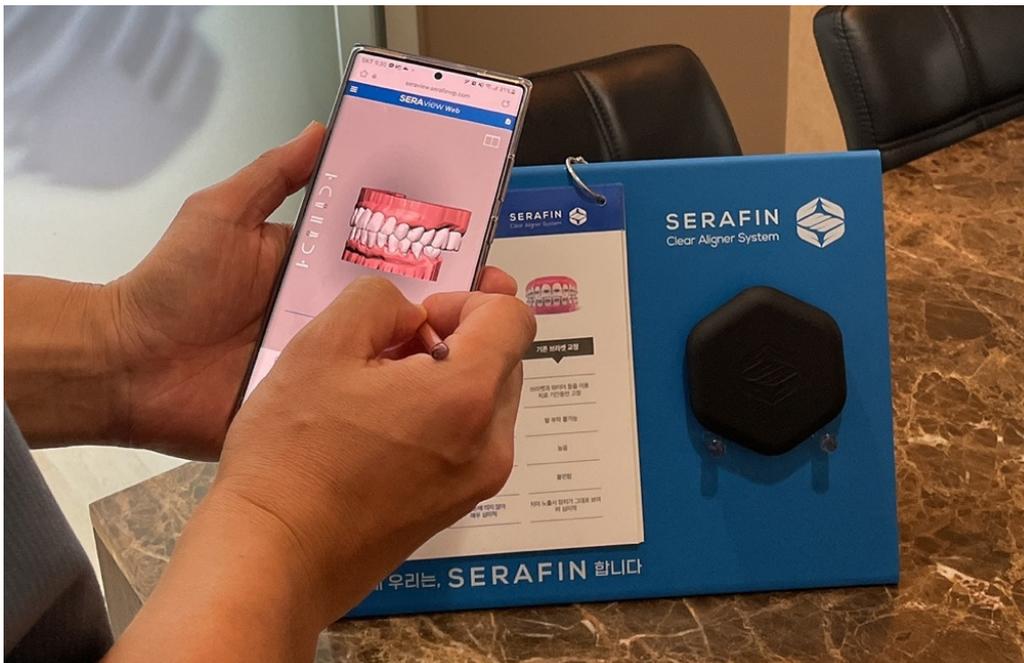


Fig. 8. SERAviewWeb on mobile phone for better communication between the manufacturer and the dentist.

### 4. Active Advice from Consultants

Clinicians who start new clear aligner orthodontic treatment often fail because of various issues at the beginning of the process. In most cases, these problems are caused by unfamiliarity in the treatment planning stage. With Serafin clear aligner system, a consultant actively advises clinicians who are starting clear aligner orthodontic treatment for the first time, assisting them in establishing realistic, appropriate treatment plans, and guidelines for future use.

### 5. Compatibility with Various Intraoral Scanners

With certain clear aligner system, only STL files obtained from a specific brand of intraoral scanner can be applied during the manufacturing process. Although intraoral scanners can be used for a variety of purposes in the dental practice, it is inefficient to limit their use to a specific brand. The Serafin clear aligner system is not limited to a specific brand, and the STL file extracted from all products can be applied (Fig. 9), including the STL file obtained through the model scanner. In addition, unlike some clear aligner orthodontic systems that can only use STL files obtained from specific clinics, the Serafin clear aligner system can be applied in any setting, and perform remote treatment as well.



**Fig. 9.** Specially designed mobile cart equipped with Medit i700 IOS (IntraOral Scanner).

So far, we have investigated the general characteristics of clear aligner orthodontic treatment and the special features of Serafin clear aligner system. While the esthetic needs of adult patients are increasing due to rising income levels, conventional bracket orthodontic treatment can interfere with social life during the treatment process. The clear aligner orthodontic system satisfies the needs of contemporary patients, and the treatment result is also not far behind conventional bracket orthodontic treatment. Among the numerous clear aligner orthodontic systems, Serafin clear aligner system is expected to play an important role in the clear aligner orthodontic market while satisfying patients both in the treatment process and in the results.

**How to cite this article:** Kim DH. Serafin: A Superior System in Clear Aligner Technology. *J Clin Digit Dent.* 2021;3(3):14-21. [www.jcdd.org](http://www.jcdd.org)

New Horizon of Digital Orthodontic software

# DICAO<sup>n</sup> 4D



# Frequently Asked Questions on Endodontics

Kiyoung Yoo, DDS, MSD

## Introduction

Root canal treatment procedures are not only fascinating and absorbing but also have good prognosis, even under ordinary practice conditions. However, problems such as blockage of the root canal, short fillings, perforation of teeth, and separation of rotary instruments can be stressful and, in severe cases, lead to endodontic phobia for clinicians. It is a basic human instinct to worry about the things we are not fully comfortable with.

In this article, I have prepared frequently asked questions related to problems clinicians face during root canal treatments and their answers. I hope this will be of help to several clinicians.

## Frequently Asked Questions

### Q. Is there a good way to anesthetize the mandibular molars?

A. The success rate of inferior alveolar nerve block anesthesia using only the 2% lidocaine ample is lower than expected (Fig. 1). The administration of local anesthetic injections causes some distress, leading dentistry to be reconsidered as a career at some point in the past.<sup>1</sup> Therefore, poor anesthesia is a concern for all dentists. There are two methods I use to increase the success rate of anesthesia for mandibular molars.

Tooth	Success rate (%)	Failure rate (%)
2nd molar	65	17
1st molar	51	23
2nd premolar	58	19
1st premolar	60	21
Canine	52	32
Lateral incisor	34	44
Central incisor	10	58

1.8 mL of 2% lidocaine with 1:100,000 epi. for the IANB

Fig. 1. Anesthetic success and failure rates with 1.8 mL of 2% lidocaine and 1:100,000 epinephrine for inferior alveolar nerve block.

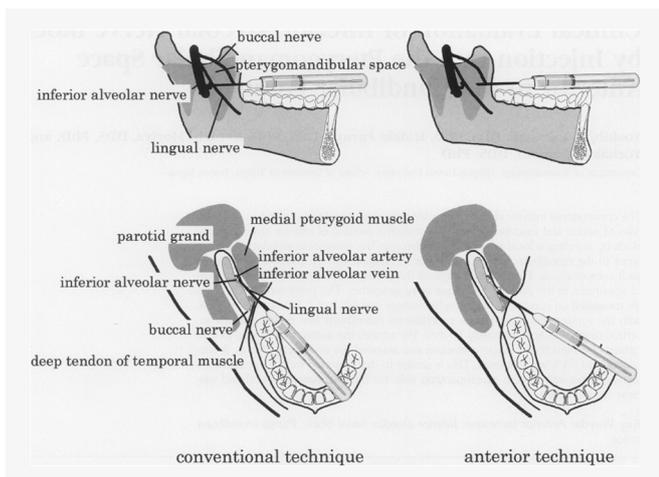


### Kiyoung Yoo

Dr. Yoo graduated from the Dankook University School of Dentistry in 2007 and became a Diplomate of the Korean Board of Conservative Dentistry in 2014. He maintains a part-time private practice limited to endodontics in Seoul. He is a member of Association of Practical Endodontic eXperts (APEX) and runs Endodontic Mirrorwork Microscope Seminar course ([dreammedical.co.kr/workshop](http://dreammedical.co.kr/workshop)) since 2019. He can be reached via email at [rky620@gmail.com](mailto:rky620@gmail.com).

### I. Anterior technique

There is a difference between the conventional technique in which the needle enters across the occlusal surface of the first molar and the anterior technique in which the needle enters from the premolar direction.<sup>2</sup> The insertion depth is approximately 10 mm, and the needle is placed in the space between the medial pterygoid muscle and the deep tendon of the temporal muscle. (Fig. 2). I use the conventional technique with half of the lidocaine ample; the rest is used during the anterior technique.



**Fig. 2.** Schematic diagrams show the relationships between the pterygomandibular space and the landmarks for the insertion and the angles of the syringe for the anterior and conventional techniques. For the anterior technique, the needle tip can be placed posterior to the deep tendon of the temporal muscle in the pterygomandibular space in the direction of the first molar lateral to the pterygomandibular raphe, with an approximate depth of penetration of 10 mm.

### 2. Articaine

Articaine has a different chemical structure from those of other amide-based anesthetics, including lidocaine. It is more lipid soluble and easily penetrates lipid barriers such as nerve membranes. It also has a rapid onset and a long duration of action (Table I).<sup>3</sup>

Articaine anesthesia is achieved by infiltration on the buccal side because lingual anesthesia has little effect.<sup>4</sup> Articaine has been associated with an increased incidence of paresthesia by five times when used for inferior alveolar nerve block anesthesia, and it is not recommended for block anesthesia.<sup>5</sup>

Sixty patients who visited the hospital twice a week apart and were anesthetized with articaine during one session and lidocaine during the other session for buccal infiltration of the mandibular first molar were evaluated. Articaine anesthesia had a significantly higher success rate and shorter onset duration than lidocaine anesthesia. It was also deeper and maintained for a longer duration.<sup>6</sup> For patients who are less responsive to anesthesia, buccal infiltration anesthesia with articaine may help.

**Table 1** Physicochemical properties of articaine and lidocaine

Agent	Chemical configuration	Molecular wt.	pKa	Lipid solubility	Protein binding (%)	Onset (min)	Duration (pulpal [min])
Lidocaine HCl 2% w/adrenaline 1:100,000	<chem>CC1=CC=C(C=C1NC(=O)CCN)C</chem>	234	7.7	4	65	8.7	60
Articaine HCl 4% w/adrenaline 1:100,000	<chem>CC1=CC=C(C=C1NC(=O)OC)C2=CC=C(C=C2)NC(=O)C(C)N</chem>	320	7.8	17	95	7.4	60-75

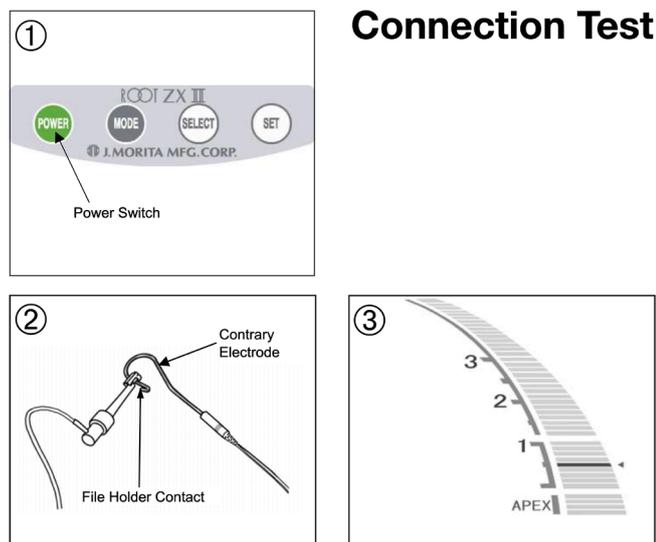
**Table I.** Physicochemical properties of articaine and lidocaine.

### Q. What is the access cavity preparation method for calcified teeth?

A. In general, when forming the root canal cavity, in the case of molars, it has been recommended that the molars should be entered until they feel like they are falling towards the bur and the region with the largest pulp; this will be palatal for the maxillary molar and distal for the mandibular molar. However, this method is problematic when the volume of the pulp cavity is reduced. When the teeth are calcified, the height of the pulp cavity can be less than the diameter of the bur, and they will not feel like they are falling. It follows that when you rely on the feeling of the bur falling during a root canal cavity formation in calcified teeth, perforation may occur.

Therefore, when the pulp chamber is completely calcified in maxillary molars, the first canal to look for is MBI, as it is easiest to locate relative to adjacent cervical root contours.<sup>7</sup> The pulp horn of the mesiobuccal canal is the highest even when there is calcification.

If the distance from the occlusal surface to the pulp chamber is known, a root canal cavity can be safely formed. Based on the results of a total of 200 maxillary and mandibular molars, this distance is almost constant. The average distance from the buccal cusp to the pulp chamber ceiling of maxillary molars is 6.24 mm, and the average distance from the buccal cusp to the pulp chamber ceiling of mandibular molars is 6.36 mm. At 7 mm below the buccal cusp, the pulp chamber is likely to have been reached. In 97% of mandibular molars and 98% of maxillary molars, the ceiling of the pulp cavity is in the Cemento enamel junction(CEJ).<sup>8</sup> I believe that this information will be helpful during endodontic access preparation of the calcified teeth.



**Fig. 3.** Connection test. 1. Press the power switch to turn on the unit. The measurement display will appear. 2. Place the metal part of the file holder in contact with the lip hook. 3. Check that all the canal length indicator bars on the display are lit, the word "APEX" flashes, and the beep is audible and continuous.

### Q. How do you use the Electronic Apex Locator (EAL) correctly?

A. There are three things I always remember when using EAL.

#### I. Connection test

This test is for checking the function and should be done at the beginning of every day.

- 1) Press the Power switch to turn on the unit. The measurement display will appear.
- 2) Check that the probe cord is properly plugged into the jack.
- 3) Check that the file holder and lip hook are properly connected to the probe cord
- 4) Touch the metal part of the file holder with the lip hook
- 5) Check that all the canal length indicator bars on the display are lit, the word "APEX" flashes, and the audible beep becomes continuous (Fig. 3).

#### 2. Reach the APEX or ZERO (0) sign

The second step is to reach the APEX or zero sign.

According to various studies and books, EALs should always be used to achieve the "zero" reading for greatest accuracy and not any point short of this.<sup>9,10</sup> After the apex or zero sign of the EAL, 0.5 mm is subtracted from the length to set the apex length.

#### 3. Saline or water

Third, to minimize the error, the EAL is used with saline or water in the root canal.<sup>11</sup>

After the connection test, the working length should be measured in the following order:<sup>12</sup>

- 1) Ensure the absence of excess fluid (irrigant, blood, or pus) in the pulp chamber or coronal half of the root canal
- 2) Place the lip hook on the lip of the patient
- 3) Place a small file (e.g. ISO size 8 or 10) into the root canal and attach the file clip
- 4) "Watch-wind" the file gently and apically until the display on the EAL indicates that the file tip is at the apical foramen (known as the "zero reading" and displayed as either "APEX," "red segment," or "0")
- 5) Ensure that the silicone stop on the file is contacting a coronal reference point before removing the file
- 6) On removing the file, measure the recorded length
- 7) Determine the working length by subtracting 0.5-1.0 mm from the recorded "zero reading"

Most reports suggest that 0.5 mm should be subtracted from the length of the file at the point when the device suggests that the file tip is in contact with the PDL (zero reading). This does not mean that the constriction is located; rather it means that the instrument is within the canal and close to the PDL. It is not appropriate to rely on any device reading 0.5 mm short of the foramen as this will often be inaccurate.<sup>13</sup>

### Q. What are the Nickel-titanium (NiTi) file selection criteria?

A. The criteria for selecting a NiTi file, in my opinion, are heat treatment and cross-sectional design.

#### I. Heat treatment

Conventional NiTi files are restored to their original shape when bent and released, while those that have been heat-treated retain their shape; they become soft and ductile, and this has two advantages.

First, the resistance to fatigue fracture is greater for heat-treated than normal NiTi files. A file will last longer after rotations with than without heat treatment.

Second, because heat-treated NiTi files do not tend to fully straighten during the preparation of curved root canals, there are fewer problems that occur, such as ledge, which occurs when staying in the middle of the root canal, and apical zip, which occurs when staying at the end of the canal.

#### 2. Cross-sectional design

The second criterion for selecting NiTi is the cross-sectional design. When a torsional force was applied to various cross-sectional shapes, those that resisted torsion the most were the S-type large and convex triangle.<sup>14</sup> The heat-treated NiTi files are soft and ductile, but it can be vulnerable to torsional fracture, and the cross-sectional design can compensate for that. Two types of files meet the two criteria of heat treatment and cross-sectional shape: DentsplySirona's ProTaper Gold and SSWhite's V-Taper 2H (Fig. 4).

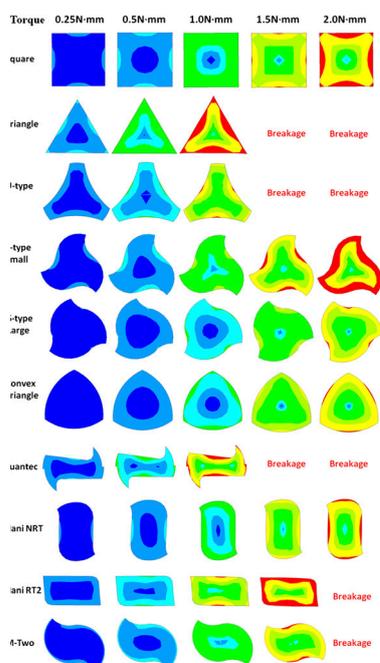


Fig. 4. Contour map showing the distribution of von Mises stresses for 10 instruments of different cross sections, with each (pseudo)color corresponding to the stress range.

### Q. What is the recommended concentration and duration of application of sodium hypochlorite (NaOCl)?

A. The recommended concentration is 6%, and the duration of application is 40 minutes after root canal shaping.

#### I. Concentration

I use stock solution (5.25% or 6%) for the following reasons.

(1) Most American Association of Endodontists members using 5.25% or greater (2) This is most effective at dissolving necrotic tissue. (3) This is the best concentration for removing vital tissue.

As regards tissue dissolution ability, 5.25% NaOCl is stable for 10 weeks, whereas the diluted solution is relatively stable for up to 1 week, with the effect decreasing significantly after 2 weeks.<sup>15</sup> Therefore, diluted NaOCl is recommended to be used within a week.

NaOCl in stock solution also has the best bactericidal effect. When bacteria extracted from teeth with chronic apical periodontitis were cultured and placed in different solutions for 15 minutes, only the 6% NaOCl had no bacteria, no biofilm, and no bacterial growth.<sup>16</sup>

In an experiment that tested 15 specimens of gram-positive *Enterococcus faecalis*, a bacterium frequently found after unsuccessful root canal treatment, cultured in different NaOCl concentrations for 40 minutes, only 5.25% NaOCl inhibited growth in every sample. The 2.5% NaOCl inhibited growth in 7 of 15 samples, whereas 1.3% NaOCl did not inhibit any growth.<sup>17</sup>

According to a report, the healing rate was higher a year after performing root canals with 5% than with 1% NaOCl.<sup>18</sup>

Based on these points, important considerations for the cleaning procedure are as follows:

- 1) Concentration
- 2) Application time
- 3) Activation (sonic, ultrasonic)<sup>19</sup>

Additionally, I believe that the use of a sonic or ultrasonic activation device should not lead to reduction of the NaOCl concentration or shorten the NaOCl application time.

Since the root canal system is different for each patient, there is no consensus on the duration it takes to clean the root canal. However, some clinicians have made recommendations. Dr. Buchanan recommends irrigating the necrotic for 20 minutes and the vital for 40 minutes while replacing the 5.25% NaOCl every 5 to 10 minutes. This can be viewed as the minimum guideline.<sup>20</sup>

I perform NaOCl soaking for 5 minutes on the first day, 20 minutes on the second day, and 5 minutes on the last day for a total of 30 minutes after shaping for molar root canals that finish after 3 times for 30 minutes each. If symptoms persist, additional soaking is performed.

In addition, warming 1% NaOCl to 45 degrees, because the tissue dissolution ability is similar to 5.25% NaOCl, has also been recommended.<sup>21</sup> It seems to be a good idea, but there is one caveat because of the heat-treated NiTi files that are being released recently. Conventional NiTi has austenite at room temperature and a strong and hard state, but the heat-treated NiTi file has martensite, which is soft and ductile at room temperature. In this bent state, the file is in the de-twinned martensite state, but when it is heated, there are changes to a hard austenite state, and the soft properties of the NiTi file due to heat treatment are lost.

Therefore, temperature can affect the physical properties of the NiTi file, and I recommend using it for NaOCl soaking after it has been shaped if you want to heat NaOCl. One should also consider it safer to use a product with temperature control than to heat NaOCl by pouring hot water from a water purifier.

**Q. What is the reason and solution for canal negotiation not working?**

A. I will provide an answer based on Dr. Buchanan's article, which helped me a lot in canal negotiation.<sup>22, 23</sup> The reason we cannot go through is because there is an impediment. There are two types of impediments (Fig. 5).

**1. Anatomic impediment**

- a) Apical irregularity at the terminus of a relatively straight canal
- b) Irregularity on the outside wall of a curved canal
- c) Abruptly curved canal

**2. Iatrogenic impediment**

- a) Apical blockage
- b) Apical Ledge
- c) Remnant of instrument

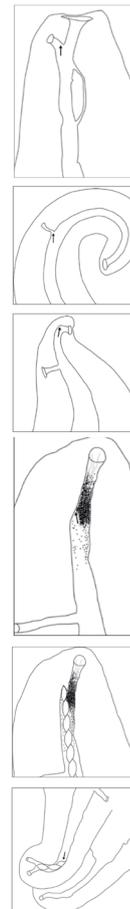
On encountering such impediments, there is loose resistance to apical file placement. It is loose and there is no binding of the file in the canal, but it feel like it is hitting a brick wall. The impediment is most likely an abrupt canal curvature, not apical calcification.

To overcome this resistance, the tip of the #10 K-file should be bent, and the rubber stop should be pointed in the same direction as the curve. Every time apical resistance was met, the file was withdrawn a millimeter; turned 10 degrees, and watch-wound again. The file will move further when its curvature and that of the root canal match.

When negotiating a canal, the recommendation is to always start with #8 K-file and use a lubricant such as RC-Prep. The reason for starting with #8 file is that #8 and #10 files cut the pulp tissue like a knife in a narrow root canal, but #15 file acts as a piston, which has the potential to push pulp tissue into the root canal.

Therefore, it is always safe to start canal scouting with the #8 file for small canals and the #10 file for large canals such as maxillary palatal and mandibular distal single canals, no matter how large they are.

**Iatrogenic impediment Anatomic impediment**



1. Apical irregularity at the terminus of a relatively straight canal
2. Irregularity on the outside wall of a curved canal
3. Abruptly curved canal
1. Apical blockage
2. Apical Ledge
3. Remnant of instrument

**Fig. 5.** Two types of impediments. Anatomic and iatrogenic.

The reason for using lubricant such as RC-Prep is that the root canal is highly likely to be blocked by pulp tissue in vital cases and not dentinal debris. This lubricant emulsifies the tissue to prevent re-adherence, and it can decrease the chance of fibrous apical blockage early in treatment. During the negotiation process, the hand file should always be in a watch-winding motion when entering or exiting the root canal. Pressure should be lightly applied to the apical end, and it should be rotated 20-30 degrees clockwise and counterclockwise. Then, the file will advance naturally.

It is very difficult to negotiate a calcified root canal. Since root canal calcification occurs in the apical direction from the pulp chamber; there is always an apical point in any calcified canal that is not obstructed, if you can just get to that level in the root.

In a calcified root canal, a "¼ turn-and-pull" file motion is useful, and it involves a 90-degree turn and a pull when the file is bitten. Files bent to negotiate severely curved canals must be smoothly bent, not kinked, and they must be bent to the last flute. K-file sizes #6-10 are so flexible that the only part of those instruments that needs to be bent is the last 1 mm. A final tip for wild canals.

If you have to battle to get a file to the entire length through a tortuous canal form, be certain to take a file that is 2-3 mm long and work it with 20 or 30 push-pull strokes before taking it out of the canal. Premature removal may preclude it from ever getting back never to length again.

### Q. Why are my root canal fillings always short?

A. There are three possibilities:

#### I. Diameter at the gutta-percha (GP) cone tip is too great

In this case, the diameter of the master cone put in is larger than the diameter of the prepared root canal.

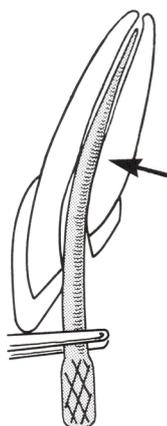
The solution is to select a cone suitable for the apical diameter by cutting it at 0.5-mm increments until a tug-back is felt.

Manufacturers are only required to produce GP to an ISO (International Organization for Standardization) regulated tolerance of  $\pm 0.05$  mm.

As a clinical example, when the final shaping file carried to length is a size #30/.06, then the clinician typically selects a system-based correspondingly sized GP. However, in accordance with ISO tolerances, this GP could have a tip diameter anywhere between 0.25 mm and 0.35 mm.

After examining the #30/.04 GP cone sizes from various companies, only 13-20% were #30, and some did not contain any #30.<sup>24</sup> Assuming that the GP cone is manufactured according to the ISO standard, the solution is to insert a GP with a number two steps smaller than the MAF into the desired GP gauge and cut it.

In other words, if the preparation of the root canal with the #30 NiTi file has been completed, the #20 GP should be inserted into the #30 GP gauge and cut with a blade.



**Fig. 6.** Gutta-percha cone binding in the coronal half (arrow) but loosely fitted in the apical half giving a false sense of a tight fit (tug-back).

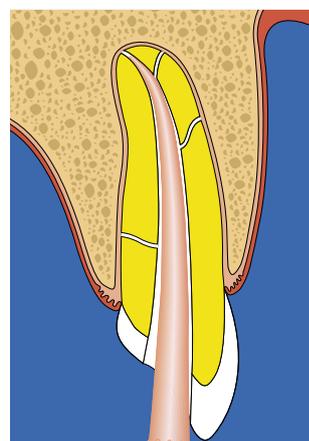
### 2. The master cone taper is larger than the root canal taper

The difficulty with the master cone reaching the apex may be a result of a taper of the master cone being larger than that of the formed root canal.

The solution is to choose a master cone with a smaller taper than the taper of the root canal, else it can be bind in the middle or coronal part of the root canal even if the diameter of the GP is small (**Fig 6**). This way, a false tug-back sensation can be felt.

The schematic diagram of the ideal cone fit is provided in **Figure 7**.

When the taper of the GP is smaller than the taper of the prepared root canal, there is a tug-back in the apical part, which prevents overfilling when the GP is cut and compacted with a plugger. After attaining the desired length and the tug-back, it can be ascertained if the GP has reached the desired position when inserting it back into the root canal after applying the sealer by squeezing it tightly with tweezers to mark the position.



**Fig. 7.** The cone must be slightly shorter than the preparation. Note the notch created by the cotton pliers at the level of the reference point of the rubber stop.

### 3. Insufficient apical preparation

Preparation may be insufficient even if the NiTi file has reached the apex, and it is necessary to check whether the last used NiTi file enters the apex easily.

This is because the K-file and NiTi file have tolerances for the 0.02-mm ISO standard.

This graph compares 25.04 NiTi files from different manufacturers. They are all 04 tapers for #25, but the sizes are different (Fig. 8).<sup>25</sup>

We expect the canal to be prepared with the No. 30 file and the cone to fit with the #30 GP, but in reality, the canal is formed with #28-32 files, and the cone fit with #25-35 GPs.

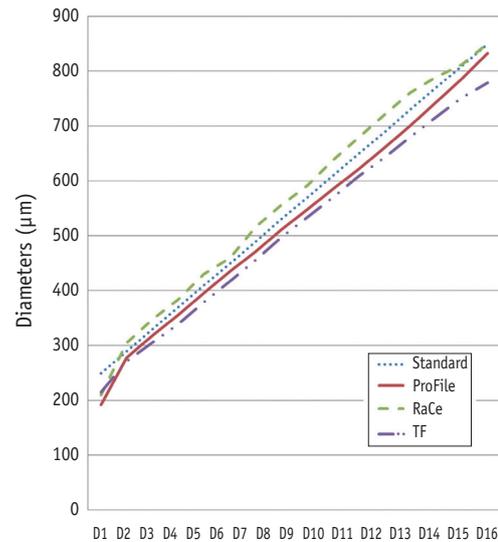


Fig. 8. Mean value of diameter of 0.04 taper Ni-Ti rotary files at each level.

### Q. My patients feel pain during root canal treatment, what should I do?

A. It is very difficult when the patient continues to complain of pain when there is nothing more to be done. You need to check the following:

#### 1. Occlusal reduction

Patients with irreversible pulpitis and percussion pain who complained of moderate-to-severe pain were fewer when occlusal reduction was performed.<sup>26</sup> Occlusal reduction also reduced the number of patients who felt pain after instrumentation and root canal filling.<sup>27</sup>

#### 2. Apical patency

Apical patency refers to keeping the apical portion of the canal well maintained, clean, and open by passing the apical foramen with a small file through the apical foramen. Debris accumulate in the root canal during its preparation, and patency is important for removing the debris at the apex. You may be worried that the pain will get worse because you will be operating the instrument beyond the root of the tooth. There are reports that checking patency reduces pain,<sup>28</sup> and there is no need to worry.

### 3. Apical size

Pain may persist if there is residual pulp or bacteria due to insufficient root canal enlargement.

To prepare a root canal with an appropriate size, it is necessary to understand the apical size of each root canal. This process is called apical gauging.<sup>29</sup> The purpose is to measure the diameter of the tip of the root canal and assess the apical diameter prior to cutting final shape. No effort is made to cut dentin. Since the coronal and middle portion of the root canal would have already been widened, if a dentin chip comes out on the flute 1–2 mm at the very end of the file, it can be inferred that the minor diameter of the root canal has been “touched.”

After checking the dentin chip on the flute at the end of the file, you can move on to the tactile gauging process, which determines the size of the major diameter. The purpose of tactile gauging is to find the largest size file that can reach the apex using the NiTi K-file. Root canal preparation is completed when final shaping is performed with a rotary NiTi file of the same tip size.

For example, after visual gauging with the NiTi file #25, it should be ascertained if the hand file #30 can reach the apex. If it does not reach the apex, no further size increase is necessary; however, if it reaches, the #35 hand file should be checked. If #30 reaches but #35 does not, the #30 NiTi file can be used.

### 4. Irrigation

The root canal system has a very complex structure, and several parts do not come into contact with the NiTi file.<sup>30</sup> If the root canal cleaning time is insufficient, it is necessary to disinfect the root canal system by performing additional procedures.

## Reference

1. JF Simon, B Peltier, D Chambers et al. Dentists troubled by the administration of anesthetic injections: Long-term stresses and effects. *Quintessence Int* 1994;25:641-646.
2. Y Takasugi, H Furuya, K Moriya et al. Clinical evaluation of inferior alveolar nerve block by injection into the pterygomandibular space anterior to the mandibular foramen. *Anesth Prog* 2000;47:125-129.
3. G Bartlett, J Mansoor. Articaine buccal infiltration vs lidocaine inferior dental block - a review of literature. *Br Dent J* 2016;220:117-120.
4. JG Meechan, AA Jaber, IP Corbett et al. Buccal versus lingual articaine infiltration for mandibular tooth anaesthesia: a randomized controlled trial. *Int Endod J* 2011;44:676-681.
5. AS Gaffen, DA Haas. Retrospective review of voluntary reports of nonsurgical paresthesia in dentistry. *J Can Dent Assoc* 2009;75:579.
6. D Robertson, J Nusstein, A Reader et al. The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. *J Am Dent Assoc* 2007;138:1104-1112.
7. LS Buchanan. The Art of Endodontics: Access Procedures. *Dent Today* 1993;7:48-53.
8. AS Deutsch, BL Musikant. Morphological measurements of anatomic landmarks in human maxillary and mandibular molar pulp chambers. *J Endod* 2004;30:388-390.
9. HF Ounsi, A Naaman. In vitro evaluation of the reliability of the Root ZX electronic apex locator. *Int Endod J* 1999;32:120-123.
10. D Hoer, T Attin. The accuracy of electronic working length determination. *Int Endod J* 2004;37:125-131.
11. E Kim, SJ Lee. Electronic apex locator. *Dent Clin North Am* 2004;48:35-54.
12. Patel S, Barnes JJ. *The Principles of Endodontics*, 2nd ed.: Oxford; 2013: 144-145.
13. MH Nekoofar, MM Ghandi, SJ Hayes et al. The fundamental operating principles of electronic root canal length measurement devices. *Int Endod J* 2006;39:595-609.
14. EW Zhang, GSP Cheung, YF Zheng. Influence of cross-sectional design and dimension on mechanical behavior of nickel-titanium instruments under torsion and bending: a numerical analysis. *J Endod* 2010;36:1394-1398.
15. BR Johnson, NA Remeikis. Effective shelf-life of prepared sodium hypochlorite solution. *J Endod* 1993;19:40-43.
16. MS Clegg, JF Vertucci, C Walker et al. The effect of exposure to irrigant solutions on apical dentin biofilms in vitro. *J Endod* 2006;32:434-437.
17. B Retamozo, S Shabahang, N Johnson et al. Minimum contact time and concentration of sodium hypochlorite required to eliminate *Enterococcus faecalis*. *J Endod* 2010;36:520-523.
18. N Verma, P Sangwan, S Tewari et al. Effect of different concentrations of sodium hypochlorite on outcome of primary root canal treatment: A randomized controlled trial. *J Endod* 2019;45:357-363.
19. YS Cho. Endodontics Course 'In-Depth' Hands-on Seminar. 2016.
20. LS Buchanan. The art of endodontics. A system-based approach to endodontic therapy: Lubricants, irrigants and chelating agents: selection and use. 2012; Chart 11.
21. G Sirtes, T Waltimo, M Schaetzle et al. The effects of temperature on sodium hypochlorite short-term stability, pulp dissolution capacity, and antimicrobial efficacy. *J Endod* 2005;31:669-671.
22. LS Buchanan. Negotiating root canals to their termini. *Dent Today* 2000 Nov;19(11):60-2, 64, 66-71.
23. LS Buchanan. Negotiating and shaping around anatomic root canal impediments. *ROOTS* 2012;1:24-30.
24. KP Cunningham, MP Walker, JC Kulild et al. Variability of the diameter and taper of size #30, 0.04 gutta-percha cones. *J Endod* 2006;32:1081-1084.
25. KW Kim, KM Cho, SH Park et al. A comparison of dimensional standard of several nickel-titanium rotary files. *Restor Dent Endod* 2014;39:7-11.
26. M Parirokh, AR Rekabi, R Ashouri et al. Effect of occlusal reduction on postoperative pain in teeth with irreversible pulpitis and mild tenderness to percussion. *J Endod* 2013;39:1-5.
27. RS Emara, HMAE Nasr, RME Boghdadi. Evaluation of postoperative pain intensity following occlusal reduction in teeth associated with symptomatic irreversible pulpitis and symptomatic apical periodontitis: a randomized clinical study. *Int Endod J* 2019;52:288-296.
28. IE Yaylali, S Kurnaz, YM Tunca. Maintaining Apical Patency Does Not Increase Postoperative Pain in Molars with Necrotic Pulp and Apical Periodontitis: A Randomized Controlled Trial. *J Endod* 2018;44:335-340.
29. LS Buchanan. The art of endodontics. A system-based approach to endodontic therapy: Apical gauging. 2012; Chart 8.
30. OA Peters, K Schönenberger, A Laib. Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro computed tomography. *Int Endod J* 2001;34:221-230.

**How to cite this article:** YOO KY. Frequently Asked Questions on Endodontics. *J Clin Digit Dent*. 2021;3(3):23-30. [www.jcdd.org](http://www.jcdd.org)

# PLATINUM COURSE

각 분야의 주제를 심층적으로 다루는 고급 코스



김도훈 원장  
서울N치과



최용관 원장  
엘에이치과

## COURSE 1

### 상악동, 원데이 총정리

임플란트 식립을 위해 반드시 알아야 할 상악동의 평가 및 처치법

#### <Hands-On>

- 측방 접근법을 통한 상악동저 거상술
- 치조정 접근법을 통한 상악동저 거상술

일자 10월 23일 (총1회)

시간 토) 15:00~23:00

등록비 20만원 (정원 20명)



장원건 원장  
치과마일스톤즈



김도훈 원장  
서울N치과

## COURSE 2

### 정답이 있는 임플란트 교합과 교합기 가지고 놀기

임플란트 교합과 교합기 사용의 모든것

#### <Hands-On>

- 중심위 유도, Facebow transfer, 교합기 셋팅

일자 10월 30일 (총1회)

시간 토) 16:00~22:30

등록비 30만원 (정원 12명)



임필 원장  
NY필치과



이동운 과장  
중앙보훈병원

## COURSE 3

### GRAFT 완전정복 (골이식&연조직이식 마스터)

All about GBR, APF, FGG, CTG, 즉시식립, 전치부 심미임플란트

#### <Hands-On>

- 절개 및 봉합, APF, FGG, CTG, GBR at Pig jaw

일자 11월 13-14일, 27-28일 (총4회)

시간 토) 15:00~22:00  
일) 10:00~18:00

등록비 120만원 (정원 15명)



노관태 교수  
경희대치과병원



장원건 원장  
치과마일스톤즈

## COURSE 4

### 아름답고 기능적인 총의치 정복

총의치 제작의 모든것 (상급)

#### <Hands-On>

- 상,하악 왁스립 제작 및 조절, 교합기 마운팅
- 예비인상 및 교합 채득, 트레이 디자인
- 상,하악 총의치 치아배열

일자 11월 13-14일 / 27-28일 (총4회)

시간 토) 17:00~22:00  
일) 9:30~17:00

등록비 100만원 (정원 20명)



이승규 원장  
4월31일치과

## COURSE 5

### 지대치 삭제, 최소한 이것만은 !

지대치 삭제를 위해 반드시 알아야 할 원칙과 실습

#### <Hands-On>

- 전치부, 구치부 크라운 삭제

일자 12월12일(총1회)

시간 일) 10:00~18:00

등록비 80만원 (정원 15명)

# CRYSTAL COURSE

개원의로서 생존하는 실전 노하우를  
핵심적으로 다루는 베이직 코스



장원건 원장  
치과마일스톤즈

**COURSE 1**

## 총의치, 이것만 알면 환자가 기다려진다

총의치 기본 원칙 확실히 배우기

<Hands-On>

- 기성트레이 예비인상 및 제작, Border Molding
- 왁스림 제작과 조절
- 상악 전치 치아 배열

일자 9월 11-12일 (총2회)

시간 토) 17:00~22:00  
일) 9:30~17:00

등록비 50만원 (정원 12명)



최민식 원장  
서울스마트치과



이창훈 원장  
서울스마트치과

**COURSE 2**

## 한국치의임상 Field Manual : 엔도, 레진편

슬기로운 엔도 생활 & 레진, 인레이 보다 쉽게하기

<Hands-On>

- ENDO : A/O 및 Filling, 충전 실습
- 다양한 상황에서 러버댐 적용하기
- Sectional Matrix 실습

일자 10월 24일 (총1회)

시간 일) 9:30~17:30

등록비 10만원 (정원 15명)



최용관 원장  
엘에이치과

**COURSE 3**

## 개원가에서 꼭 필요한 구강내 소수술 및 발치술

술전평가 및 술후 발생 가능한 합병증까지 총 정리!

<Hands-On>

- 봉합술, 발치술
- I&D, 소대 절제술, 난발치를 위한 골삭제법 etc.

일자 10월 30-31일 (총2회)

시간 토) 15:00~22:00  
일) 9:00~19:00

등록비 60만원 (정원 20명)



박철완 원장  
보스틴원치과



장원건 원장  
치과마일스톤즈



김도훈 원장  
서울N치과

**COURSE 4**

## 더 이상 필요없는 1차교정의 모든것 (Feat. Interceptiv orthodontics)

부분교정 및 1차교정의 모든것

<Hands-On>

- 전치 MTA, Bracket Bonding
- Wire engagement

일자 12월 11일 (총1회)

시간 토) 15:00~22:00

등록비 30만원 (정원 20명)

**\*개별 접수 가능 / Hands-on 세미나로 진행**

등록 온라인 등록(OFDENTIS.com) > Community programs > 교육신청

문의 02-919-8312      장소 덴티스 서울 문정 캠퍼스 (서울 송파구 문정동 법원로 11길 7, 2층)

# JCDD

Journal of Clinical & Digital Dentistry

[www.JCDD.org](http://www.JCDD.org)