DENTAVANTGART

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INTERVIEW

DR. JAVIER VASQUEZ

AN 'ORDINARY' BUT VERY PASSIONATE DENTIST/MASTER CERAMIST

DR. **JON GURREA**

DEALING WITH THE UNEXPECTED

DR. **JORDI MANAUTA** &
DR. **DAN LAZAR**

TEXTURE

MAXIMUM PROTOCOL SIMPLIFICATION

SUNG BIN IM, MDC, CDT, BS &
SOMKIAT AIMPLEE, DDS, MSC, FACP

ESTHETIC AND FUNCTION

FULL MOUTH REHABILITATION WITH LITHIUM DISILICATE CERAMIC

DDS. **RAFAEL LAPLANA** &
DDS., CDT. **ANABELL BOLOGNA**

A CHALLENGE OF SEVERE ATROPHY IN THE ANTERIOR ZONE

DR. **MARCO MAIOLINO** &
CDT. **EMANUELE TARASCIO**

ADHESIVE DENTISTRY

WITH PARTIALLY BONDED CERAMICS

CASE

Sung Bin Im, MDC, CDT, BS
Somkiat Aimplee, DDS, MSc, FACP
Aram Torosian, MDC, CDT
Alvaro Blasi, DDS, CDT
Sergio R. Arias, DDS, MS
Jimmy Londono, DDS
Gerard Chiche, DDS

ESTHETIC AND FUNCTION
FULL MOUTH REHABILITATION WITH LITHIUM DISILICATE CERAMIC

Esthetic and functional rehabilitation in a severely worn dentition patient is always a challenge due to the lack of initial cosmetic references and strength concerns.

A meticulous step-by-step interdisciplinary treatment plan, along with good communication between the restorative dentist, orthodontist and ceramist team using smile design and diagnostic wax-up as communication tools are key factors of success.

Definitive material selection according to the etiology of the worn dentition, risk factors and tooth structure conditions are also essential for treatment success.

This article shows a step-by-step interdisciplinary treatment approach of an esthetic and functional full mouth rehabilitation. Using highly translucent all-ceramics in severely worn dentition patient, and proper communication between clinician and technician team is a critical requirement.

Clinical Case

The patient is a 55-year-old male who presented at the Ronald Goldstein Center for Esthetic and Implant Dentistry at Augusta University, College of Dental Medicine with generalized severely worn dentition, and desired esthetic and functional improvements.

[1 b, c] Preoperative occlusal view

ETIOLOGY OF WORN DENTITION

Dental erosion was a cause of his worn dentition after differential diagnosis was made from the nature and the location of the wear facets combined with a history of acidic fruit and beverage intake for several years.

(Figs 1a to 1c)

CLINICAL PROCEDURE

Preliminary impressions were made with polyvinyl siloxane material (Flexitime, Heraeus Kulzer, USA) to fabricate study casts for diagnosis, treatment plan and to create a diagnostic Wax-Up.

(Figs 2a to 2c)

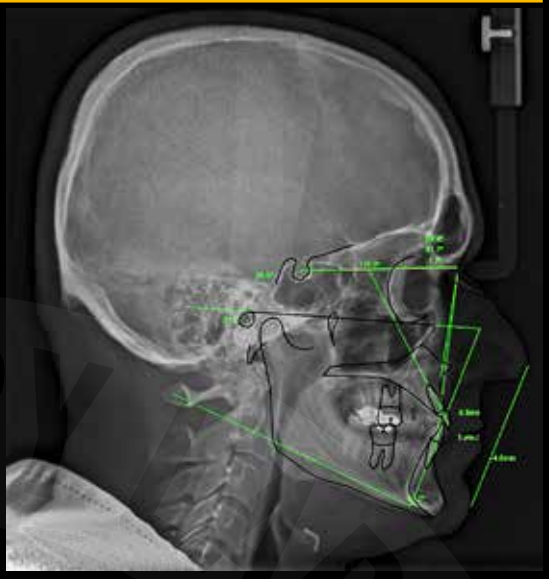
[2 a, b, c] Fabricated study cast for diagnosis

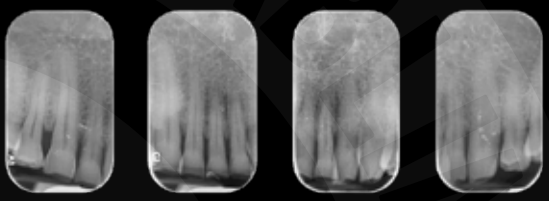
Orthodontic Treatment

INTERDISCIPLINARY PLAN

The orthodontic treatment was performed to align tooth position/occlusion and manage space to create ideal tooth position and gingival levels alignment to pleasing tooth length/proportion for his smile design plan **(Figs 3a to 3f)**.

Crown lengthening surgery procedure to correct gingival levels in this case was a contraindication, due to the short clinical roots of his maxillary incisors.





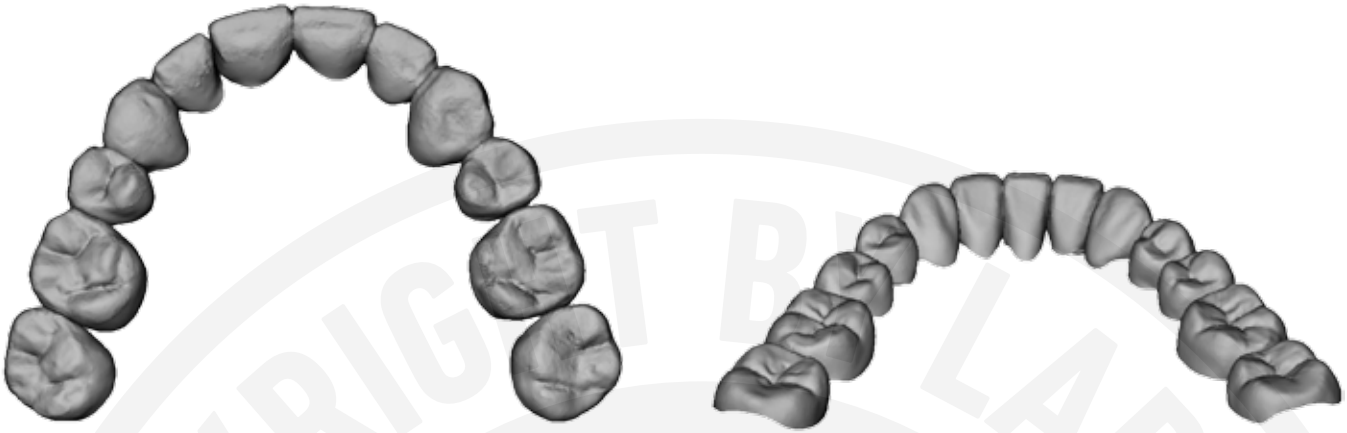
[3a-e] Performed orthodontic treatment to align tooth position/occlusion and manage space to create ideal tooth position and gingival levels alignment

[3f] Intraoral view after completion orthodontic treatment

DIAGNOSTIC WAX UP BLUEPRINT FOR PREDICTABLE DEFINITIVE RESTORATION

The diagnostic wax up was created following the smile design setting pleasing display, length and proportion: the design is planned from incisal edge up.

The wax-up serves as a blueprint setting the occlusal plane and the vertical dimension. After setting the anterior length and volume, the posterior teeth were waxed to set the proper occlusal plane and establish the vertical dimension to be tested in the provisional phase **(Figs 4a to 4c)**.



[5a,b]
Digital design of CAD/CAM provisional

[5c]
Labial aspect of the milled PMMA provisional

[5d,e]
Occlusal aspect of the milled PMMA provisional

DIGITAL CAD/CAM PROVISIONAL TECHNOLOGY

CAD/CAM provisional restorations were used to maximize precision by transferring exacting information from the diagnostic wax-up to the milled CAD/CAM prosthesis.

The interim restoration plays an essential role in the protocol of full-mouth rehabilitations. It is considered the blueprint for fabrication of the definitive restoration and should be accurate in all respects. For this patient, a CAD/CAM provisional was fabricated using the shell technique. There are several advantages for this treatment modality:

(1) high strength due to less porosity,
(2) durable and long-lasting material, and
(3) chair-side time devoted to relining, trimming, and polishing the cervical areas with minimal occlusal adjustment.

[5f]
Upper and lower provisionals were in position according to the esthetic and functional protocol

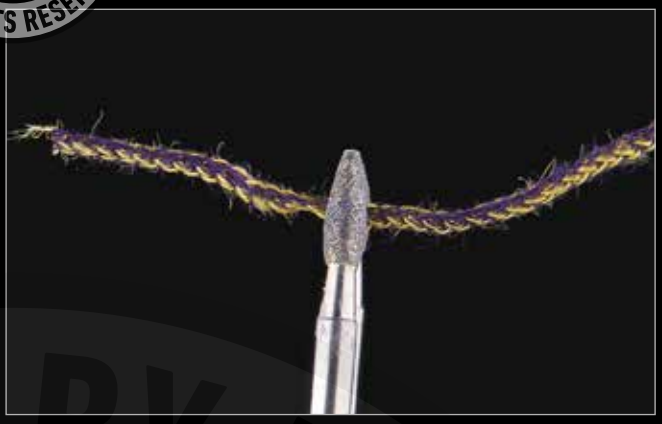
The full-mouth wax-up was scanned for fabrication of CAD/CAM shells **(Figs 5a to 5b)**. It is important to note the accuracy of the maxillary shell in occlusion against the mandibular shell **(Fig. 5c)**. The provisional restorations were fabricated, finished, polished, and delivered **(Figs 5d and 5f)**.

PREPARATION

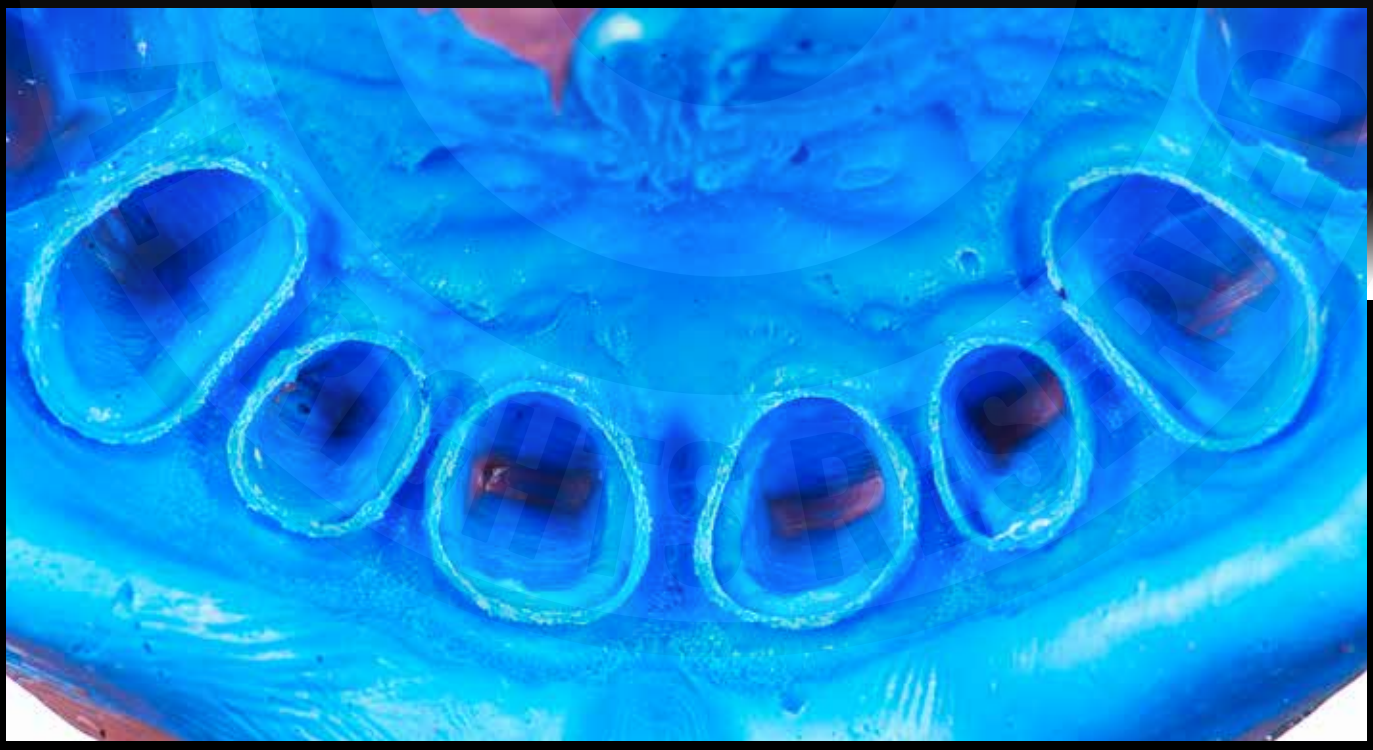
Anterior and posterior crowns were fabricated separately to simplify procedures for final impression, occlusal registration, mounting, crowns fabrication, delivery, and occlusal adjustment. Using the posterior provisional crowns to keep vertical dimension and centric occlusion allowed to stage the treatment in anterior and posterior phases.

Additional benefits of this segmental treatment are minimum amount of anesthesia per appointment time, and optimum patient comfort.

This technique requires, however, precise provisional restorations from accurate diagnostic wax-up because the definitive restorations are fabricated following the provisional restorations as a blueprint **(Figs 6a to 6d)**



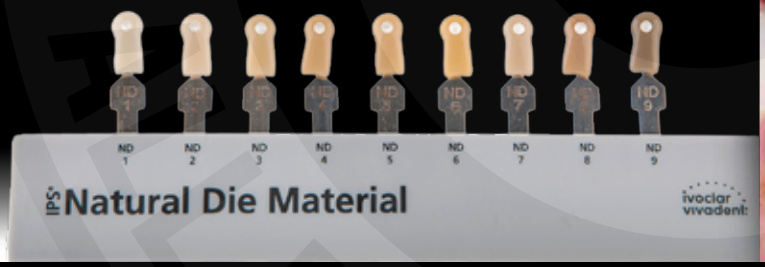
IMPRESSION



DIGITAL PHOTOGRAPHY

Digital photography plays an essential role in achieving more predictable and high-quality results in restorative dentistry. Digital photography can assist the ceramist significantly to analyze tooth anatomy, morphology and texture. This will allow to replicate the observations in the final restorations for a lifelike appearance. In addition, it can be a very useful diagnostic tool to communicate with patients so that they can better understand their condition **(Figs 7a to 7e)**.

DIFFERENT ANGLES



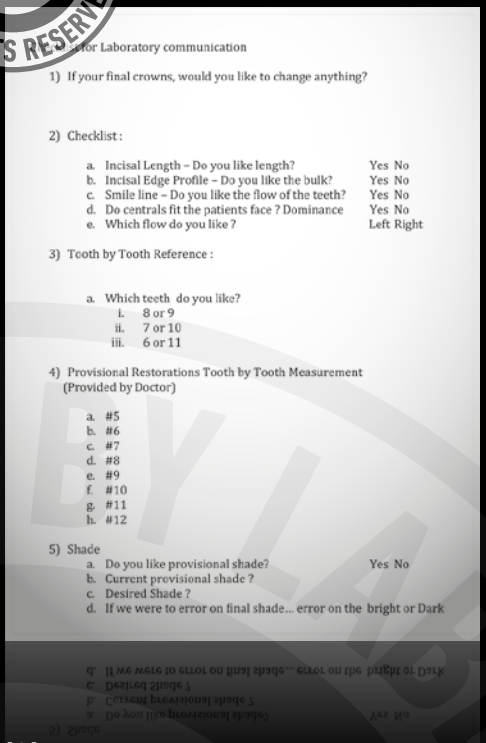
[7 b, c]
Stump shade taking with IPS Natural Die Material

ESTHETIC CONSULTATION

On the preparation day, we use the CLC checklist to establish a common understanding, vision, and effective communication between dentist, ceramist and patient.

The information gathered during this appointment is very critical and extremely useful as it allows us to understand the patients' desire for the final outcome of the restorations. It also allows us to gather information on tooth length, volume, smile line, reference teeth and any changes to be implemented in the final restorations.

It also provides us exacting information on cervical-incisal length of the provisionals, which can be replicated in the final design. In addition, we will gather information on current provisional shade, target shade as well as stump shade at this same appointment. We now expect predictable results when transferring the information from the prototype to the final restorations **(Fig. 8)**.



for Laboratory communication

1) If your final crowns, would you like to change anything?

2) Checklist :

a.	Incisal Length – Do you like length?	Yes No
b.	Incisal Edge Profile – Do you like the bulk?	Yes No
c.	Smile line – Do you like the flow of the teeth?	Yes No
d.	Do centrals fit the patients face ? Dominance	Yes No
e.	Which flow do you like ?	Left Right

3) Tooth by Tooth Reference :

a. Which teeth do you like?
   i. 8 or 9
   ii. 7 or 10
   iii. 6 or 11

4) Provisional Restorations Tooth by Tooth Measurement (Provided by Doctor)

a. #5
b. #6
c. #7
d. #8
e. #9
f. #10
g. #11
h. #12

5) Shade

a.	Do you like provisional shade?	Yes No
b.	Current provisional shade ?	
c.	Desired Shade ?	
d.	If we were to error on final shade... error on the bright or Dark	

[8] CLC Checklist: Shade, Shape, Translucency, Texture etc.

WAX-UP AND PROCESSING OF PRESSED CERAMICS

The wax-ups for the crowns were fabricated on the basis of patients' gender, age, personality, face shape, and tooth proportion **(Figs 9a and 9b)**. They were also designed to meet the terms of functional and esthetic expectations **(Figs 9c to 9f)**. To that effect, Ivan Ronald waxing tools were used to create a pleasing and natural look **(Fig. 9g)**.

[9a,b] Wax-up crowns were fabricated on the basis of patients gender, age, personality, face shape, tooth proportion

[9g] Ivan Ronald waxing tools were used to create a pleasing and natural look shapes

PRESS & CUT-BACK

The maxillary and mandibular anterior crowns were pressed using a lithium disilicate glass-ceramic (IPS e.max Press, Ivoclar Vivadent) **(Fig. 10a)**. The LT BL4 ingot was chosen based on the final shade and stump shade **(Fig. 10b)**. A delicate divesting process was carried out using fine glass beads. After pressing, the cut back was designed to mimic natural dentin structure **(Figs 11a to 11c)**. The cut-back stage should be given much attention to ensure that the minimum thickness of entire pressed restorations is no less than 0.6mm. It is very critical to use the correct grinding instruments so to avoid chipping and cracks **(Fig. 11d)**.

[10 b]
LT BL4 ingot was chosen based on the final shade and stump shade (Final Shade 1M1)

[11 d]
It is very critical to use the correct grinding instruments

[11 c]
After pressing, designed cut back to mimic natural dentin structure

CERAMIC LAYERING PROCEDURES: BODY AND FRAME

The pressed restorations were cut back on the labial aspect of the maxillary and mandibular anterior teeth. A dentin layer was carried out using BL3 dentin, which is one shade brighter than the final shade in order to enhance value **(Fig. 12a)**. For construction of natural translucent and mamelon effects, T-Blue, OE1, Neutral, MM Light, BL3 Dentin were used segmentally in the incisal area **(Figs 12b to 12f)**. The first layer firing was baked at 750°C under vacuum **(Fig. 12g)**. After first Dentin/Frame bake, the surfaces were ground very gently to avoid micro cracks in the substructure.

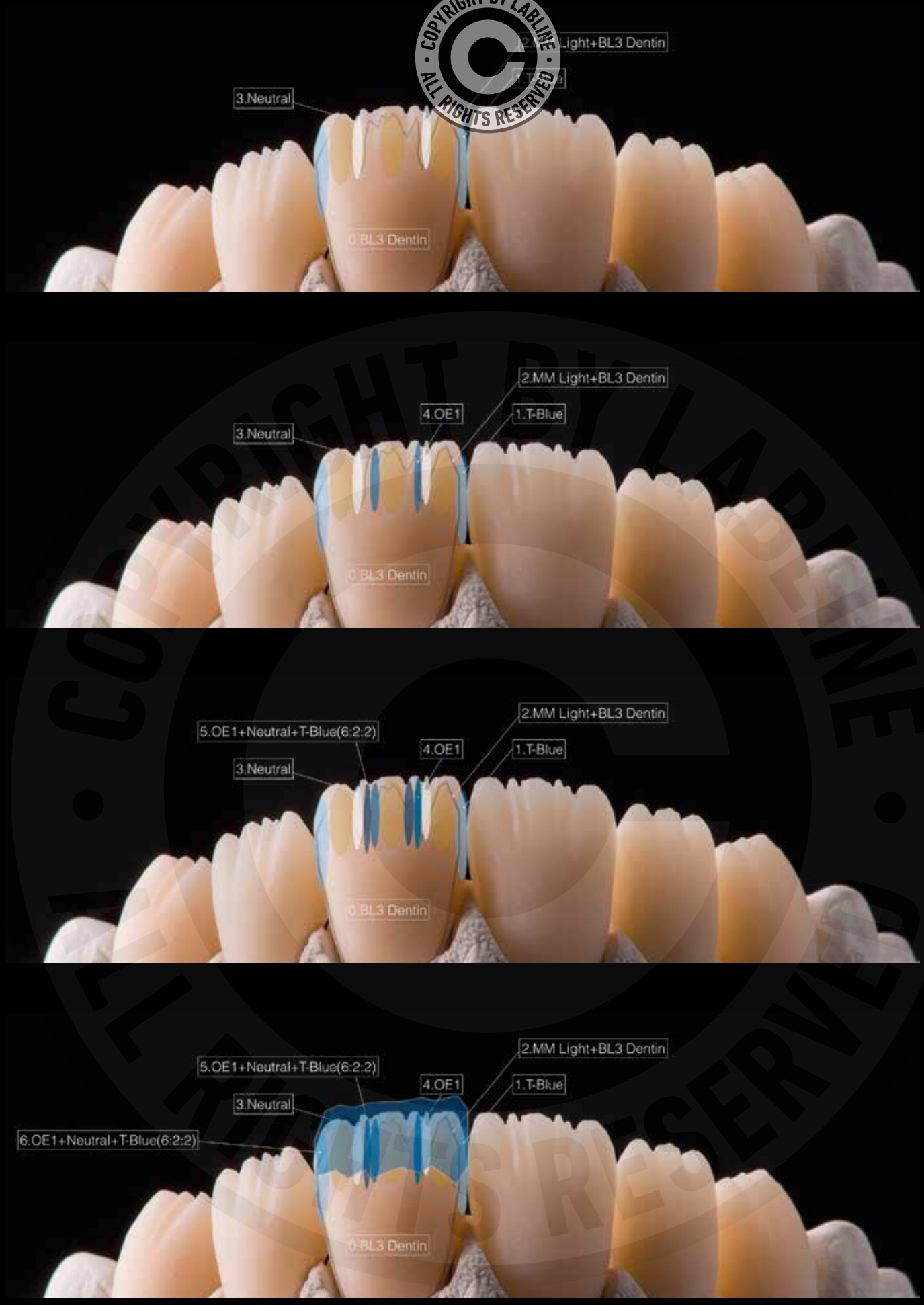
[12a] DENTIN
Applied BL3 Denin to enhance the value which is one shade brighter than the final shade, then T-Blue was applied to the mesial and distal corner areas.

[12b] MAMELON EFFECT
To reproduce mamelon effect, mamelon mixture (MM Light + BL3 Dentin) was applied with different ratios. If necessary, different mamelon effects can be reproduced:

1. Strong Mamelon: Straight MM Powders
2. Medium Mamelon: MM+Dentin
3. Weak Mamelon: Dentin

[12g] FIRING PARAMETERS FOR DENTIN & FRAME

Drying			**3:00**
Closing			3:00
Preheating	580°C		2:00
High Temperature	750°C	50°C/min	1:00
Vac (off/level/hold)	749°C	100%	--:--



[12 c, d, e, f] INCISAL FRAME

- Neutral: To enhance more the in-depth effect, Neutral was used
- OE1, OE1+Neutral+T-Blue(6:2:2) : OE1, OE1+Neutral+T-Blue(6:2:2) were applied segmentally on the incisal area
- OE1+Neutral+T-Blue(6:2:2) : OE1+Neutral+T-Blue(6:2:2) mixture were applied evenly on the incisal area

CERAMIC LAYERING PROCEDURES: INTERNAL STAIN

Internal stain stage was conducted twice to reproduce internal characterization **(Fig. 13a)**. The stain bake was carried out 50°C lower than first bake just to hold stains on the surface **(Fig. 13b)**.

[13 b] FIRING PARAMETERS FOR INTERNAL STAIN

Drying			**2:00**
Closing			2:00
Preheating	580°C		2:00
High Temperature	700°C	70°C/min	0:00
Vac (off/level/hold)	---°C		--:--

[13 a]
Internal stain stage was conducted twice to mimic internal characterization

CERAMIC LAYERING PROCEDURES: FIRST SKIN

In the third bake, three different skin mixtures were applied as a gradient to create subtle contrasts over the entire surface **(Figs 14a to 14e)**. The size of the build-up was intentionally overbuilt approximately 15% to compensate for firing shrinkage **(Fig. 14f)**. The first skin was baked at 745°C under vacuum **(Fig. 14g)**.

- Cervical 1/3: To give more chromatic effect, used I BL(70%) + Cervical Transept Yellow(30%)
- Middle 1/3: To create a high value area, I BL was used
- Incisal 1/3 : To establish more translucent area, used I BL(70%) + Neutral(30%)

[14g] FIRING PARAMETERS FOR FIRST SKIN

Drying			**3:00**
Closing			3:00
Preheating	580°C		2:00
High Temperature	745°C	50°C/min	0:45
Vac (off/level/hold)	744°C	100%	--:--

[14a] OPALESCENT EFFECT
To reproduce opalescent effect, layered I BL+T-Blue(7:3) mixture on the mesial and distal areas

[14b] CHROMATIC EFFECT
To enhance chromatic effect on the cervical area, applied I BL(70%) + Cervical Transpa Yellow(30%) mixture

[14c] BODY
To enhance the value, I BL was used

[14d] TRANSLUCENT EFFECT
The incisal 1/3 mixture is slightly more translucent than the body and cervical to allow for the internal effects to show, layered with Neutral(30%)+I BL(70%) mixture

[14e] HALO EFFECT
To achieve halo effect, IE(80%)+BL3 Dentin(20%) mixture was used randomly along the incisal edge

[14f] HALO EFFECT
Intentionally the size of the build-up was overbuilt approximately 15% to compensate firing for shrinkage

CERAMIC LAYERING PROCEDURES: SECOND SKIN

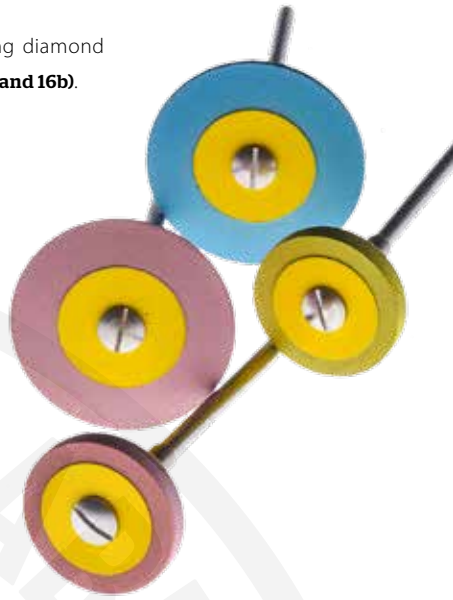
After the first skin bake, adjustments were made to enhance the tooth shapes, contacts and occlusion. Next, the correction mixture (I BL+Add-on Enamel) was applied to perform morphological corrections.
(Figs 15a and 15b)

[15 b] FIRING PARAMETERS FOR SECOND SKIN

Drying			**2:00**
Closing			2:00
Preheating	580°C		2:00
High Temperature	740°C	50°C/min	0:40
Vac (off/level/hold)	739°C	100%	--:--

CERAMIC LAYERING PROCEDURES: TEXTURE

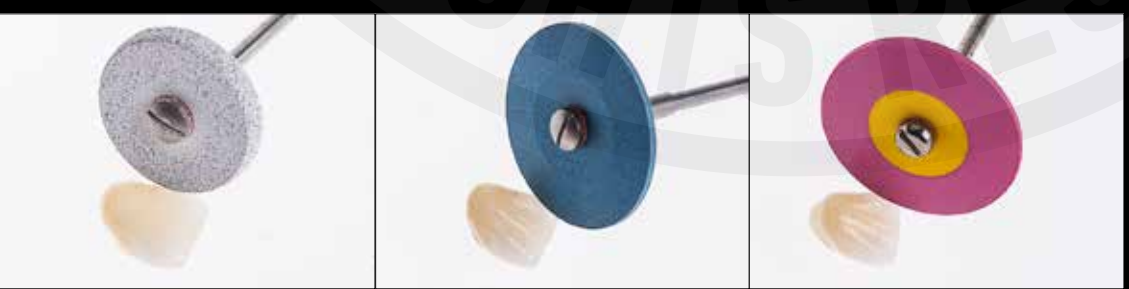
The surface texture was finalized using diamond burs, discs and silicone wheels **(Figs 16a and 16b)**.



[15 a]
Applied correction mixture(I BL+Add-on Enamel) to perform morphological corrections

[16 a]
To achieve the natural look surface texture and gloss intensity, used diamond burs, discs and silicone wheels

[16 b]
To achieve the natural look surface texture and gloss intensity, used diamond burs, discs and silicone wheels



[17 b]
After glazing, mechanical hand polishing was performed with different coarse silicone wheels and pumice in order to reproduce the uneven intensity gloss and luster

CERAMIC LAYERING PROCEDURES: EXTERNAL STAIN AND GLAZE

The external stain and glaze stages were conducted together on this case **(Fig. 17a)**. After glazing, mechanical hand polishing was performed with different coarse silicone wheels and pumice in order to reproduce the vivid intensity of gloss and luster **(Fig. 17b)**. **Figs 18a** and **18b** show the definitive restorations on the master cast.

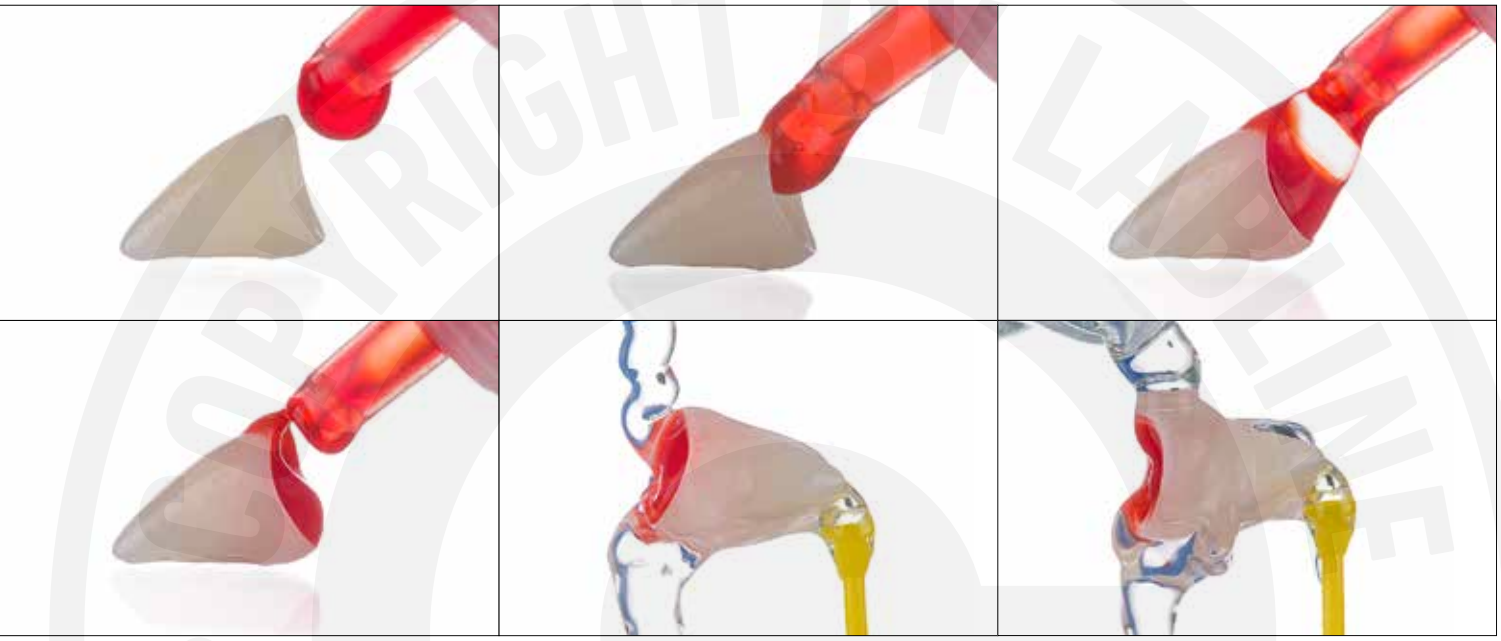
[17 a] FIRING PARAMETERS FOR EXTERNAL STAIN AND GLAZE

Drying			**2:00**
Closing			2:00
Preheating	580°C		2:00
High Temperature	740°C	60°C/min	0:40
Vac (off/level/hold)	739°C	100%	--:--

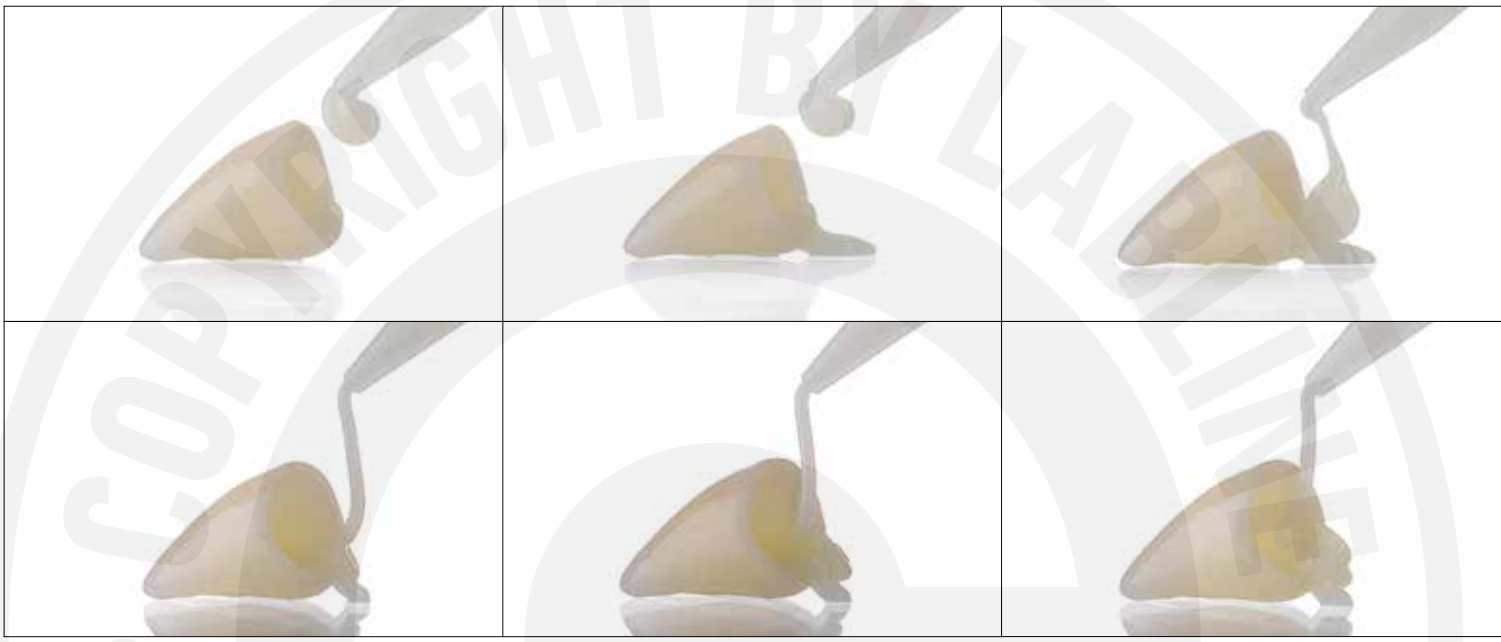
[18 a, b]
Definitive restorations on the master cast

RESTORATION TRY-IN AND BONDING PROCEDURE

The tooth preparations were cleaned with pumice and a webbed prophy rubber cup and air-particle abraded with 30-micron silica (Rocatec soft, 3M ESPE). They were then etched with 35% Phosphoric acid (Scotchbond Phosphoric Etchant; 3M ESPE) for 15 seconds, rinsed, and coated with adhesive (Single Bond, 3M ESPE) **(Figs 19a and 19b)**.

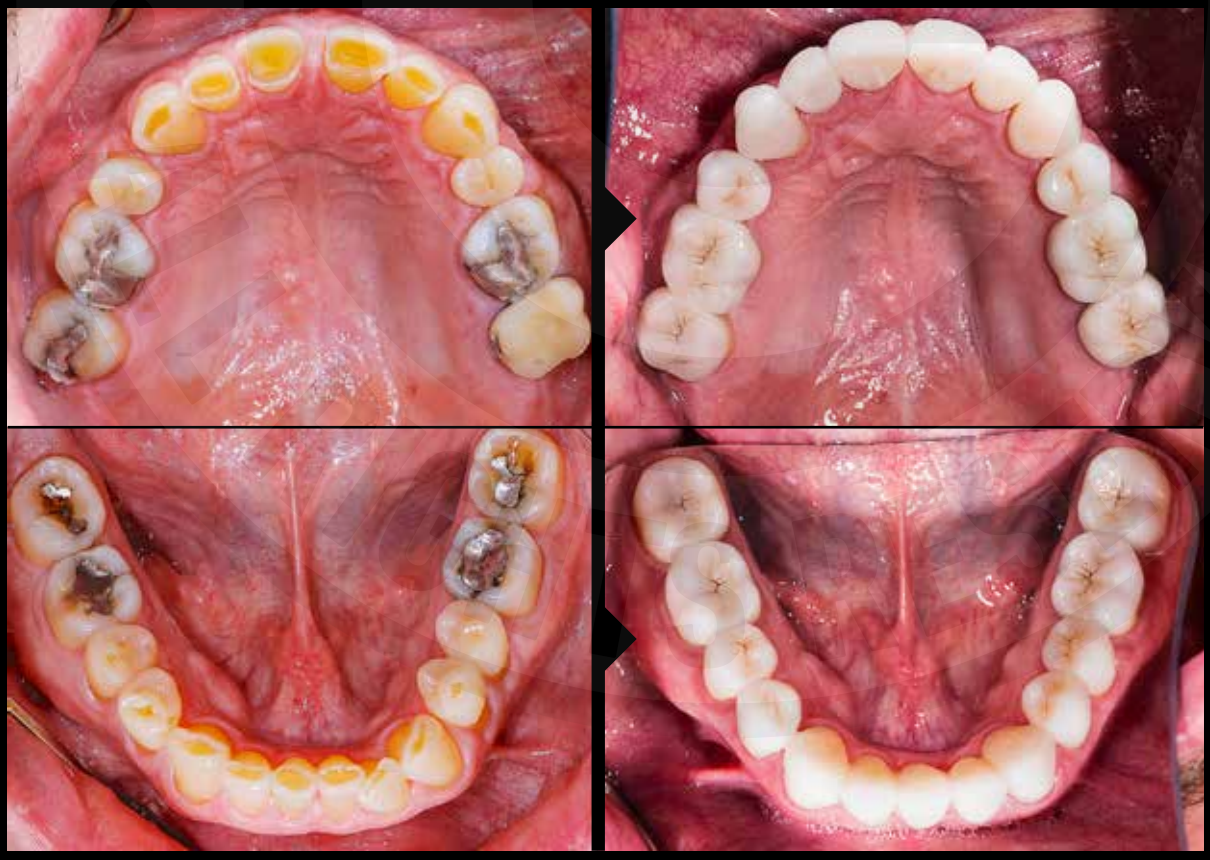


Definitive photo-polymerization was performed for 40 seconds facially and palatally after the crowns were seated with resin cement, and the excess cement was removed with a scalpel No.12 (Henry Schein, Melville, NY) **(Figs 19c and 19d)**.



CONCLUSION

This article presented the treatment sequence of the esthetic rehabilitation of a severely worn dentition caused by erosion combined with attrition. High-translucency all-ceramic restorations with meticulous design and cut-back layering in the anterior segments were combined with monolithic posterior crowns to restore the esthetics and function of this patient. A clear understanding of the disease etiology, a proper diagnosis and an understanding for material selection are essential prerequisites prior to the execution of the treatment.



AUTHORS


Sung Bin Im, MDC, CDT, BS [1]


Somkiat Aimplee, DDS, MSc, FACP [2]


Aram Torosian, MDC, CDT [1]


Alvaro Blasi, DDS, CDT [5]


Sergio R. Arias, DDS, MS [2]


Jimmy Londono, DDS [3]


Gerard Chiche, DDS [4]

RONALD GOLDSTEIN CENTER FOR ESTHETIC AND IMPLANT DENTISTRY
AUGUSTA UNIVERSITY COLLEGE OF DENTAL MEDICINE

1 Master Dental Ceramist, Ronald Goldstein Center for Esthetic and Implant Dentistry, Augusta University, College of Dental Medicine, Augusta, Georgia, USA.
2 Assistant Adjunct Professor, Oral Rehabilitation Department, Augusta University, College of Dental Medicine, Augusta, Georgia, USA.
3 Assistant Professor, Ronald Goldstein Center for Esthetic and Implant Dentistry, Augusta University, College of Dental Medicine, Augusta, Georgia, USA.
4 Director, Ronald Goldstein Center for Esthetic and Implant Dentistry, Augusta University, College of Dental Medicine, Augusta, Georgia, USA.
5 Esthetic and Implant Fellow, Ronald Goldstein Center for Esthetic and Implant Dentistry, Augusta University, College of Dental Medicine, Augusta, Georgia, USA.

CORRESPONDENCE TO: **Sung Bin Im**, Augusta University 1430 John Wesley Gilbert Drive, GC-1131 Augusta, Georgia 30912 United States | Email: SUIM@gru.edu

SUNG BIN IM (MDC, CDT, BS), USA / KOREA

Sung Bin Im is a Master Dental Ceramist at the Goldstein Center for Esthetic and Implant Dentistry, Augusta University College of Dental Medicine (Directed by Dr. Gerard Chiche)

Also Sung Bin teaches Dental Technology, Photography, and Esthetic Dentistry at the Postgraduate Prosthodontic Residency Program.

Having earned his Master in Dental Ceramics from UCLA School of Dentistry – Center for Esthetic Dental Design, under the auspices of Prosthodontist and Master Ceramist Dr. Edward McLaren (2010-2012), California, United States.

Previously, he received his Bachelor of Science degree in Dental Technology from Shin Heung University(2001-2010), Gyeonggi-do, South Korea.

ASSISTANT PROFESSOR DR. SOMKIAT AIMPLEE

Dr. Aimplee holds degree from The Srinakharintharawirote University, Thailand and Georgia Regent University (GRU) College of Dental Medicine.

Dr. Aimplee has published numerous articles on Quintescense Dental Technology and Journal of Cosmetic Dentistry.

He is a Diplomate of American Board of Prosthodontics and fellow of the American College of Prosthodontist. He is currently assistant Adjunct Professor of Oral Rehabilitation Department at GRU College of Dental Medicine, and maintains a private practice focus on Esthetic and Implant prosthetics.

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