GRADIA™ PLUS
from GC

Modular composite system
for indirect restorations

Technical Manual

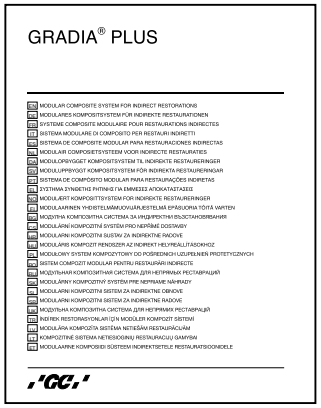
GENERAL REMARK

Prior to use, carefully read the Instructions for Use included with the sets.
For use only by a dental professional in the recommended indications.
Do not use in clinical applications that are not described as an indication.

If you become aware of any kind of undesired effect, reaction or similar events experienced by use of this product, including those not listed in this instruction for use, please report them directly through the relevant vigilance system, by selecting the proper authority of your country accessible through the following link:
https://ec.europa.eu/growth/sectors/medical-devices/contacts_en
as well as to our internal vigilance system: vigilance@gc.dental

In this way you will contribute to improve the safety of this product.

Veneering of GC GRADIA™ PLUS on different types of frameworks shall not be done without the use of recommended polymerization devices and bonding agents.
Composite restorations may require clinical repair over time, depending on the situation and the individual case.



This technical manual will give you a good idea of how easy it is to get a convincing aesthetic result with minimum effort, and highlights the excellent features of this light-cured composite for indirect techniques. Before using the material, please carefully read the instructions for use included with the sets.

This technical manual is illustrated with major works by dental specialists from throughout whole Europe and the US: MDT S. Maffei (IT), MDT R. De Paepe (BE), CDT F. Troyano (ES), MDT M. Brüsch (DE), MDT B. Marais (US), RDT S. Lusty (GB), Dr. R. Medzin (PL), RDT M. Bladen (UK), MDT P. Llobell (FR), RDT L. Johnson (UK), MDT C. Thie (DE), MDT L. Colella (IT), MDT J.A. Pamplona (ES), MDT D. Ibraimi (CH), MDT D. Galle (BE)

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1. Intended Use and Introduction

INTENDED USE

Thank you for choosing GC GRADIA™ PLUS.

MODULAR COMPOSITE SYSTEM FOR INDIRECT RESTORATIONS

With GC GRADIA™ PLUS, GC introduces a unique modular concept for dental lab indirect composite techniques.

GC GRADIA™ PLUS is a light-curable nano-hybrid composite with improved physical properties and enhanced red and white aesthetics that offers a wide range of clinical applications, unsurpassed durability, natural opalescence and excellent, lifelike aesthetics.

GC GRADIA™ PLUS will meet the needs of dentists and laboratory technicians as a restorative material for both anterior and posterior applications in the mouths of even the most aesthetically demanding patients.

INDICATIONS

Veneering of fixed dental prosthetics – framework-supported

- Veneering of metal-supported crowns and bridges
- Veneering of fixed/removable implant-supported superstructures
- Veneering of CAD/CAM fabricated frameworks
- Veneering of fiber-reinforced bridges using GC Stick/GC StickNet
- Reproduction of gum tissue fixed/removable implant-supported superstructures

Veneering of fixed dental prosthetics – framework-free

- Anterior jacket crowns, inlays, onlays and laminated veneers

Characterization and modification of fixed/removable dental prosthetics

- Masking of model cast frameworks with GC GRADIA™ PLUS pink opaques
- Characterization of prefabricated resin teeth with GC GRADIA™ PLUS Lustre Paint
- Modifications of prefabricated resin teeth with GC GRADIA™ PLUS pastes
- Modification and characterization of CERASMART™270 crowns with GC GRADIA™ PLUS Lustre Paint and/or GC GRADIA™ PLUS pastes
- Characterization of denture bases with GC GRADIA™ PLUS gum shades

INTRODUCTION

Light-cured composites for dental restorations have become popular thanks to their excellent physical properties and ease of use. With growing demand for higher aesthetics in dental treatments, superior quality has also become a crucial requirement. Consequently, one would expect to see more high-quality composites, with superior aesthetics to rank alongside porcelain.
Dentists and dental technicians, likewise, want a durable dental composite that rivals the aesthetics and durability of porcelain, but so far composite fillers have affected the translucency and opalescence of crown and bridge composite systems. With this as background and with all these requirements in mind, GC developed GC GRADIA™ PLUS.
The GC GRADIA™ PLUS project resulted in an advanced, high-strength, nano-hybrid, light-curing composite with brightness, translucency and chroma in the oral environment that is similar to porcelain.
The aesthetic potential of this novel composite system has been thoroughly reviewed. It features a bright and chromatic color approach that makes it similar to the best porcelains now available. Once in the mouth, GC GRADIA™ PLUS has an appearance that perfectly replicates the natural tooth.

STATE-OF-THE-ART CERAMIC-POLYMER TECHNOLOGY

Thanks to GC's nano-filler technology - use of high-density and homogeneously dispersed ultra-fine fillers blended into the resin matrix - GC GRADIA™ PLUS offers high mechanical properties achieved by light-curing only.
GC GRADIA™ PLUS stands out for its high wear-resistance, compacted surface and surface smoothness, which delivers durability and high gloss retention.
Taking into account its superior mechanical properties, GC GRADIA™ PLUS can be considered "gentle" on opposing teeth, which makes it particularly suitable for posterior high-wear, high-pressure restorations that are prone to chipping or cracking when made with porcelain.

MIX AND MASK

For masking metal or other frame materials, there are four V-colored opaques and one base opaque ready to be mixed to obtain the classic V-shades.
Having an excellent flow and optimized curing properties, these opaques mask color effectively and are easily and quickly light-cured.

INDICATION-RELATED CONSISTENCY OF PASTES

The different GC GRADIA™ PLUS pastes have been fine-tuned based on their typical indication and area of application. Two paste viscosities - Heavy Body and Light Body - ensure easier reproduction of the different areas of tooth structure and gingival tissue.
For production of high-aesthetic crown and bridge work, the layering technique using both consistencies in the same restoration - offers an almost unlimited number of color and texture combinations.
For fast and easy monolithic reproduction of standard V-shades, the single One Body pastes can be used with ideal results. As they are a "light body" type, they can easily be injected using a transparent mold and light-cured accordingly.

OUTSTANDING WORKABILITY

Both GC GRADIA™ PLUS Heavy Body and Light Body pastes have excellent handling properties.
Heavy Body pastes ensure a stable build-up of larger areas. They will keep their shape during the creation of internal dentin structures. The paste is non-sticky and can be shaped using a modeling spatula.
Light Body pastes are applied in smaller volumes using a modeling spatula or brush. They can even be mixed together to create your own color tone.
Both paste types can be used together in the same restoration and are very technique tolerant. As they both have the same mechanical properties, they can easily be polished to a beautiful, natural and durable gloss.

RED AND WHITE IN PERFECT HARMONY

As well as lifelike tooth shades, the GC GRADIA™ PLUS system approach offers a solution for the most complex "red" aesthetic cases. The GC GRADIA™ PLUS GUM set contains key gum shades that reproduce gingival tissue for indications such as implant superstructures and other fixed or removable prostheses like crowns, bridges and partial dentures.
The strength, durability and handling properties of GC GRADIA™ GUM shades are the same as GC GRADIA™ PLUS tooth shades (Light Body and Heavy Body pastes).
The wide variety of red shades allows you to closely match a patient's gingival tissue in color and texture, regardless of their age or ethnicity.

PAINT COLOR AND GLOSS PROTECT YOUR AESTHETICS

The numerous GC GRADIA™ PLUS Lustre Paint colors provide an extremely simple way to add long-lasting color and surface gloss. On top of that, thanks to our renowned nano-filler technology, your restorations achieve a high wear resistance.
The versatility of the Lustre Paints will impress you. You can choose from a wide variety of colors, both for internal and external characterization, leading to perfect aesthetics. They can easily be mixed together to produce even more color nuances. You can even create your own preferred consistency using the Lustre Paint Diluting Liquid.
Using this light-cured characterization coating on the surface of your work reduces the polishing stage, saving you valuable time and the technique is easy.

CURING AT THE SPEED OF LIGHT

All GC GRADIA™ PLUS shades completely polymerize in short irradiation times with the all-new GC Labolight DUO. The days when you needed two curing devices in your laboratory (one for intermediate and another for final curing) are now a thing of the past. Our state-of-the-art multi-functional light-curing device combines two curing modes: pre-curing (step mode) and final curing (full mode).

Equipped with the latest double wavelength LED technology, the Labolight DUO can be used to cure any of GC's composites in a safe and durable way, while the high power outlet means quicker light-curing cycles. Its automated rotary system and reflective plate distributes the light with optimum efficiency and exposes your work from all sides. The curing stand carefully positions the objects during all light-curing cycles.
The Labolight DUO causes no change whatsoever to the GC GRADIA™ PLUS color, so it allows technicians to see subtle colors in the final restoration throughout all phases of fabrication.

MODULAR APPROACH

GC GRADIA™ PLUS is a modular concept that allows you to step into the system wherever you like, choosing the module (set) that meets your demands or indications. You can easily add more modules, each time opening up more aesthetic possibilities and case solutions.
The color range of this novel composite has been carefully chosen, fine-tuned and adapted to the needs of the dental technician.
Compared to conventional composite systems, GC GRADIA™ PLUS has fewer standard colors, making it more compact and cost-effective.

COMPACT BUT COMPLETE - LESS IS MORE

More compact but also more complete.
The range of Light Body shades and their unique consistency allow you to use it pure or mix shades together without reducing its superior strength.
To match specific enamel areas you can easily create your own Light Body mixture: "Enamel-Opal" or "Transpa-Blue". To match more chromatic areas of dentin, simply mix your Light Body "Dentin-Orange".
So, finally you have a composite that can be mixed and that offers you a way of working similar to that of ceramic veneering.
To make it even more complete, the innovative internal and external paintable Lustre Paint colors can be used to create numerous individual colors.
And at the same time, when used externally it gives you the gloss and protection you want for your beautiful work.

A NEW STANDARD IN LIFELIKE MIXING AND LAYERING OF SHADES

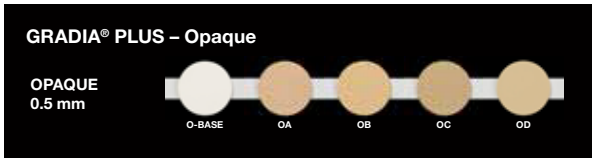
GC GRADIA™ PLUS sets a new standard for composite indirect techniques with improved aesthetics and superior mechanical properties, ensuring a long-term, permanent solution.
We are convinced that GC GRADIA™ PLUS will meet the needs of dentists and laboratory technicians as a restorative material for both anterior and posterior applications in the mouths of the most aesthetically demanding patients.

2. GC GRADIA™ PLUS Components

OPAQUE (O)

A paste-type opaque with exceptional light-curing characteristics.
A paste-type opaque that applies readily, flows easily yet will not drip or run.
Exceptional masking properties.
The 4 Opaques - A,B,C,D - and Opaque Base express all 16 basic V-tooth shades when mixed together.

Shades: O-Base, OA, OB, OC, OD.



PASTE HEAVY BODY (HB)

Exceptional build-up properties.
Ensures a stable build-up of larger areas and keeps its shape during the build-up process of internal dentin structures.
The paste is non-sticky and can be sharpened using a modeling spatula.

Opaque Dentin (OD)

When thick layers of composite cannot be applied, OPAQUE DENTIN can be used instead of/in combination with the regular DENTIN to mask the opaque/substructure and to express a deeper color.
OPAQUE DENTIN can also be used as a cervical color in order to achieve deeper shades in the cervical and root areas.

Shades: HB-ODA, HB-ODB, HB-ODC, HB-ODD, HB-ODW

Dentin (D)

Superb masking ability and exhibits a warm and brighter color that can reflect through a larger amount of enamel.

Shades: HB-DA1, HB-DA2, HB-DA3, HB-DA3.5, HB-DB1, HB-DB3, HB-DC3, HB-DD2, HB-DW

Enamel

Enamel shades to match the natural incisal areas with a natural opalescence and level of translucency.

Shades: HB-EL, HB-ED

Enamel Effect

Special enamel shades.

HB-PE

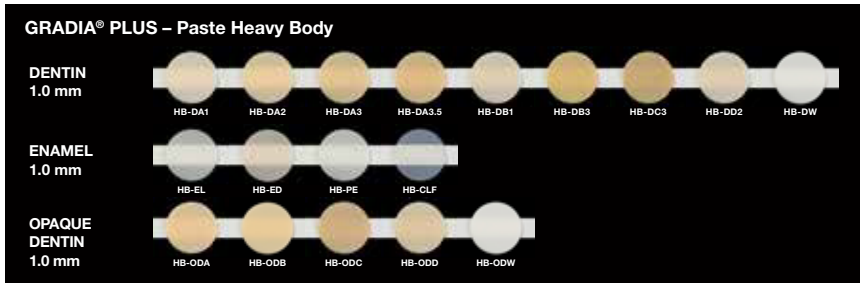
Opacious milky white enamel used at cusp tips to create decalcification spots and other white blemishes found in natural teeth.

Translucent

Translucent for matching subtleties found in natural teeth.

HB-CLF

Unique transparent shade to match the fine line of "clear material" in a natural tooth. Provides lifelike transmission and reflection of light as well as a deep realistic color in a very thin layer.



PASTE LIGHT BODY (LB)

Base shades can be considered as neutral effect shades.

LB-Base D

Superb masking ability.
Exhibits a warm and brighter color that can reflect through a larger amount of enamel.
Can be used pure or mixed with other Light Body shades to create your own color tone e.g. increasing the chroma of the shade saturation - mixing in LB-Orange with LB-Base Dentin.

LB-Base E

Enamel shade to match the natural incisal areas with a natural opalescence and level of translucency.
Can be used pure or mixed together to create your own color tone e.g. increasing the opalescence of the enamel shade - mixing in LB-Opal with LB-Base Enamel.

LB-Base CLF

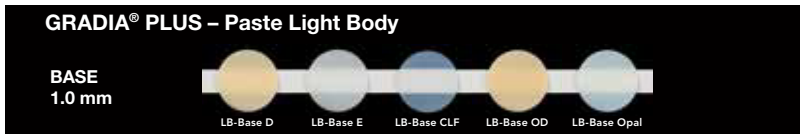
Unique transparent shade to match the fine line of "clear material" in a natural tooth.
Provides lifelike transmission and reflection of light as well as a deep realistic color in a very thin layer.

LB-Base OD

This opaque dentin shade can be used instead of/in combination with the regular DENTIN to mask the opaque/substructure and express a deeper color.
OPAQUE DENTIN can also be used as a cervical color in order to achieve deeper shades in the cervical and root areas.

LB-Base Opal

High opalescent effect shade.
Can be used pure or can be mixed with other Light Body shades to create your own color tone e.g. increasing the opalescence of the enamel shade - mixing LB-Opal with LB-Base Enamel.



EFFECT SHADES

Can be considered as colored effect shades.
Can be used pure or mixed together to create your own color tone.

LB-Orange, LB-Red, LB-Yellow, LB-Blue, LB-Grey, LB-Milky

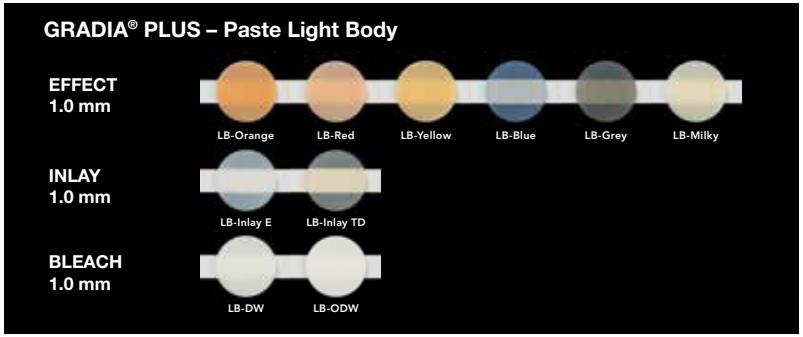
Colored effect pastes.
Can be used in different areas of the teeth - shoulder/incisal/occlusal internal body - either pure or mixed with other colors.

LB-Inlay E, LB-Inlay TD

Can be considered as universal enamel and dentin types for creation of inlays in a very easy way.

LB-DW, LB-ODW

Whitish pastes.
Can be used for very white tooth color reproduction or as an effect on cusps and other white blemishes found on natural teeth.



LUSTRE PAINT

Paint color and gloss - protect your aesthetics

The 12 GC GRADIA™ PLUS Lustre Paint colors provide an extremely simple way to add long-lasting color and surface gloss. On top of that, thanks to our renowned nano-filler technology, your restorations achieve a high wear resistance.
You can choose from a wide variety of colors, both for internal and external characterization, leading to perfect aesthetics. They can easily be mixed together to produce even more color nuances. You can even create your own preferred consistency using the Lustre Paint Diluting Liquid.
Using this light-cured characterization coating on the surface of your work reduces the polishing stage, saving you valuable time - and the technique is easy.

Shades:

- **Fitting the V-shades reproduction (fluorescent character): LP-A, LP-B, LP-C, LP-D**
- **For more individualization (fluorescent character): LP-Cream, LP-Grey, LP-Lavender, LP-Blue, LP-CLF (Clear)**
- **For gum individualization (non-fluorescent): GLP-Violet, GLP-Bright Red, LP-CL (Clear)**

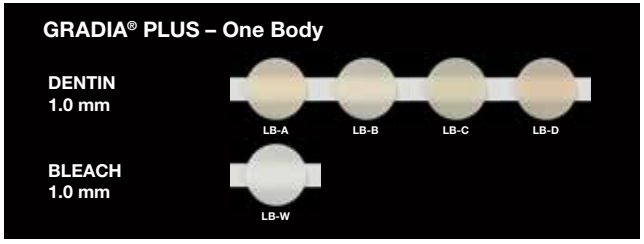
GC GRADIA™ PLUS Lustre Paint Diluting Liquid

Dedicated diluting liquid for Lustre Paint colors.
By adding a drop of this diluting liquid to the Lustre Paint colors, you can create your own preferred consistency and color tone.

PASTE LIGHT BODY (LB) FOR ONE BODY TECHNIQUE

For fast and easy monolithic reproduction of standard V-shades, the single One Body pastes can be used with ideal results.
As they are a "light body" type, they can easily be injected using a transparent mold/key and light-cured accordingly.
Perfect in combination with the Lustre Paint colors for more individualization and glossy effect.

Shades: LB-A, LB-B, LB-C, LB-D, LB-W



GUM SHADES

Red and white in perfect harmony

As well as lifelike tooth shades, the GC GRADIA™ PLUS system approach offers a solution for the most complex "red" aesthetic cases.
The GC GRADIA™ PLUS system offers key gum shades that reproduce gingival tissue for indications such as implant superstructures and other fixed or removable prostheses like crowns, bridges and partial dentures.
The wide variety of red shades allows you to closely match a patient's gingival tissue in color and texture, regardless of their age or ethnicity.
They are available in both Light Body and Heavy Body paste types, allowing you to choose the best/preferred consistency depending on the case.

Gum Shades Opaque

Paste-type opaque with exceptional light-curing and masking characteristics.
Applies readily, flows easily yet will not drip or run.
The two pink Opaques, GO-1 and GO-2, create an excellent base color and can be mixed together to offer even more individuality.

Shades: GO-1, GO-2

Gum Pastes Heavy Body

Exceptional build-up properties for larger areas, keeping its shape during the build-up process of gingival areas.
Non-sticky paste, can be sharpened using a modeling spatula.
Perfect as a base for further individualization with the Gum Light Body colors.

Shades: GHB-1, GHB-2, GHB-3, GHB-CL

Gum Shades Light Body

Unique Light Body pastes.
Special effect pastes applied in smaller volumes using a modeling spatula or brush or even directly from the syringe (using the fine nozzle tip).
Can be used pure or mixed together to create your own gum color tone.

Shades: GLB-1, GLB-2, GLB-3, GLB-CL

PRIMERS

GC offers a variety of specialized primers that nicely fit the various indications of GC GRADIA™ PLUS.
Please consult the dedicated Instructions for Use of the respective GC Primers before use.

How to ensure an optimal bond between ...	Recommended GC Primer
Metal framework – GC GRADIA™ PLUS Opaque	METAL PRIMER Z
GC GRADIA™ PLUS – GC GRADIA™ PLUS Lustre Paint	CERAMIC PRIMER II
GC GRADIA™ PLUS – GC GRADIA™ PLUS Paste	CERAMIC PRIMER II
Acrylics – GC GRADIA™ PLUS Gum Shade	GC Acrylic Primer
Zirconiumdioxide framework – GC GRADIA™ PLUS Opaque	CERAMIC PRIMER II
CERASMART™ CAD/CAM Block – GC GRADIA™ PLUS Paste	CERAMIC PRIMER II

GC ACRYLIC PRIMER

Light-curing primer for bonding GC GRADIA™ PLUS to acrylics. Increases the adhesiveness of GC GRADIA™ PLUS to conventional acrylic resins used in dental laboratory procedures like the modification of denture teeth or denture base resins.

METAL PRIMER Z

One-step resin-to-metal bonding agent.
For a strong connection between metal framework and GC GRADIA™ PLUS use METAL PRIMER Z, an easy-to-use and proven bonding agent.
A tenacious bonding agent between the first GC GRADIA™ PLUS layer e.g. Opaque and the metal framework.

CERAMIC PRIMER II

Bonding agent used for the additional application / repair of GC GRADIA™ PLUS layers (V-shades, Gum shades) and GC GRADIA™ PLUS Lustre Paint.
When individualizing hybrid ceramic CAD/CAM blocks like CERASMART™ from GC, use CERAMIC PRIMER II as the bonding agent.

ACCESSORIES

GC GRADIA™ PLUS Modeling Liquid

Modeling liquid to lubricate the spatula when applying the resin pastes.
Aid for modeling the pastes.
Wetting of spatula or brush in order to smoothen the surface.
Glass-filled (nano-filled) - no compromises in strength.
To be used moderately.

GC GRADIA™ PLUS SEPARATOR

A composite resin separator that is applied to working stone models when making inlays and onlays. It functions optimal on a Die Hardener-treated stone surface.

GC GRADIA™ PLUS DIE HARDENER

When coated on dies, hardens and preserves the surface during fabrication of inlays, jacket crowns etc.

GC GRADIA™ PLUS AIR BARRIER

This agent creates an air barrier to guarantee a complete polymerization of the composite surface and to prevent the inhibition layer.

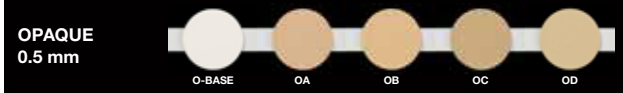
DIAPOLISHER PASTE

Fine diamond-containing polisher paste.
Used on a felt wheel to apply a lustrous finish to restorations.

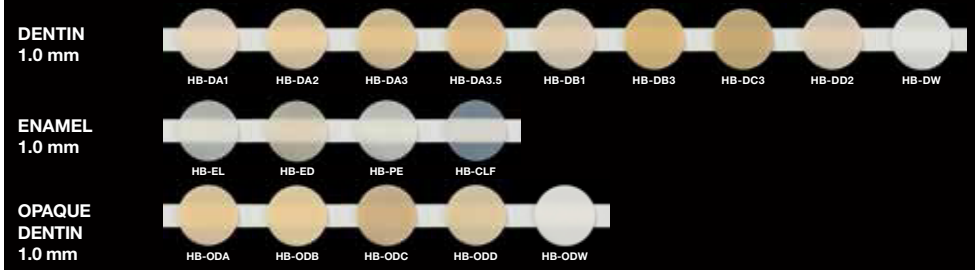
3. Color Chart

The GC GRADIA™ PLUS color range enables restorations to appear more like porcelain than other composites.

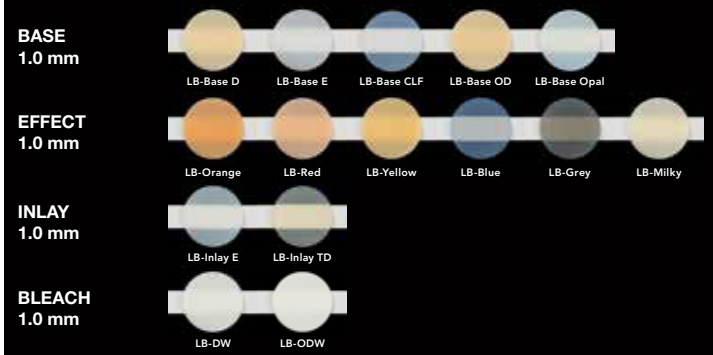
GRADIA® PLUS – Opaque



GRADIA® PLUS – Paste Heavy Body

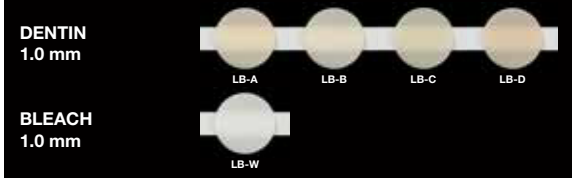


GRADIA® PLUS – Paste Light Body



GRADIA® PLUS – Gum

GRADIA® PLUS – One Body



GRADIA® PLUS – Lustre Paint

4. GC GRADIA™ PLUS Characteristics

NATURAL AESTHETICS

GC GRADIA™ PLUS translucency and color tones are similar to those of natural teeth

Its level of brightness and light transmission is similar or closer to porcelain than conventional indirect composites. Where required, the underlying tooth preparation can be masked while maintaining lifelike, natural-looking crowns. GC GRADIA™ PLUS's build-up technique mirrors that used for ceramics, either layered or painted.

Nature analogue light dynamics

When a conventional composite crown is seated under the light conditions found in the mouth, the excessively opalescent color makes it impossible to reproduce the natural color, especially when using translucent colors, and this could not be avoided until now. That has all changed thanks to the most recent polymer technology, used in GC GRADIA™ PLUS colors.

GC GRADIA™ PLUS has been fine-tuned in its translucent, opalescent and fluorescent characteristics by optimizing the filler particle size, thereby controlling and adjusting the diffusion of light through the material. The result is a more nature analogue light dynamic maintaining the desired color, created at dentin level, also when the restoration is seated in the mouth.

Masking capacity of the pastes

Opacity Levels					
100%	**High**	**Mid-High**	**Middle**	**Mid-Low**	**Low**
O-BASE	HB-ODA	HB-DA1	LB-A	HB-EL	HB-CLF
OA	HB-ODB	HB-DA2	LB-B	HB-ED	LB-Base CLF
OB	HB-ODC	HB-DA3	LB-C	HB-PE	LB-Inlay CLF
OC	HB-ODD	HB-DA3.5	LB-D	LB-Base E	LB-Inlay E
OD	HB-ODW	HB-DB1	LB-W	LB-Orange	GLB-CL
GO-1	HB-DB3	HB-DD2		LB-Yellow	LB-Blue
GO-2	HB-DC3	HB-DW		LB-Milky	LB-Grey
	LB-Base OD	LB-Base D		LB-Base Opal	
	LB-ODW	LB-DW		LB-Red	
	GLB-1	GLB-2			
		GLB-3			

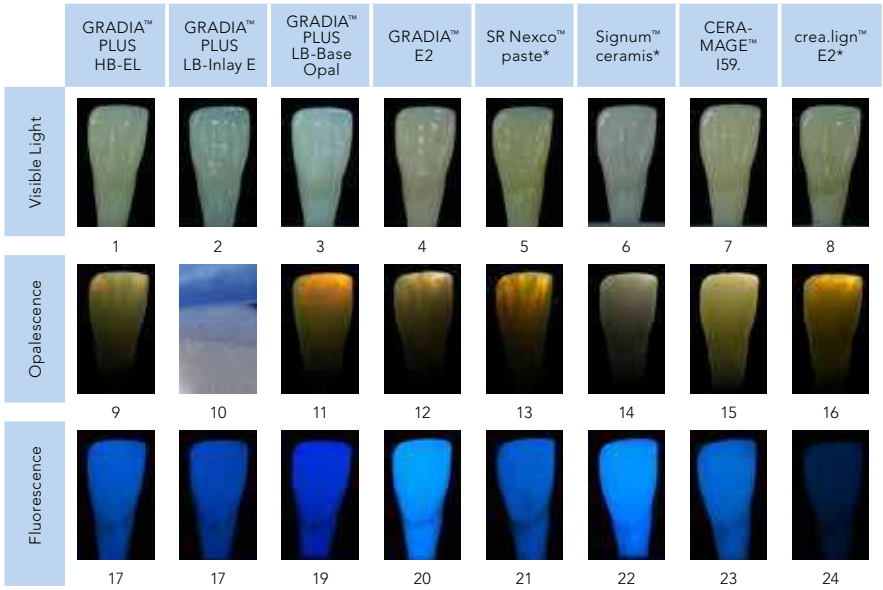
Opalescence levels of the pastes

Opalescence Levels		
High	**Middle**	**Low**
LB-Base Opal	HB-EL	Others
	HB-ED	
	HB-PE	
	LB-Base E	
	LB-W	
	LB-Milky	

Comparative indirect composites under different light conditions

In transmitted visible light, the nature analogue light dynamic properties of GC GRADIA™ PLUS restorations become evident - opalescence and translucency similar to natural teeth.

When using incident light, the fluorescence and luminosity of GC GRADIA™ PLUS restorations becomes visible and plays and supports the true-to-nature light dynamics of GC GRADIA™ PLUS restorations.



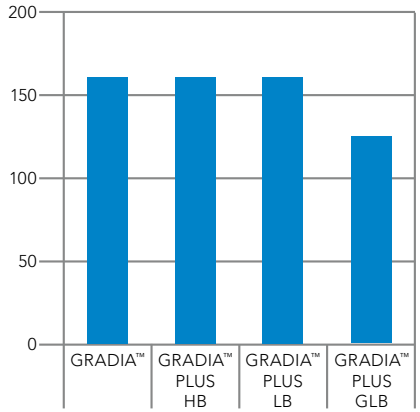
Note:
*no GC Brands. Findings based on internal testing.

WHEN-STATE-OF-THE-ART TECHNOLOGY IS A MUST HAVE

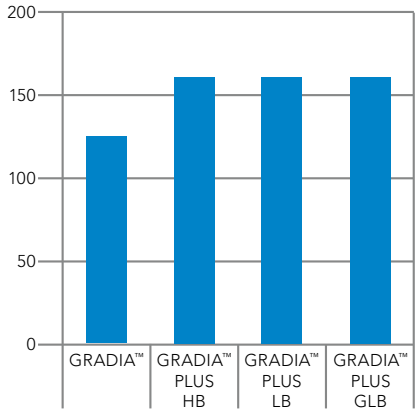
Today's patients not only expect their restorations to look perfect, they also expect that brilliant smile to last "forever".
GC GRADIA™ PLUS doesn't stand out just because of its aesthetic features; the technological evolution of this new material means it also stands out for its high wear-resistance, compacted surface and surface smoothness, and it therefore delivers durability and high gloss retention.

The strength, durability and handling properties of the entire GC GRADIA™ PLUS shade range are the same, regardless of whether you are working with the V-shades or gum shades, or are working with the Light Body or Heavy Body pastes.

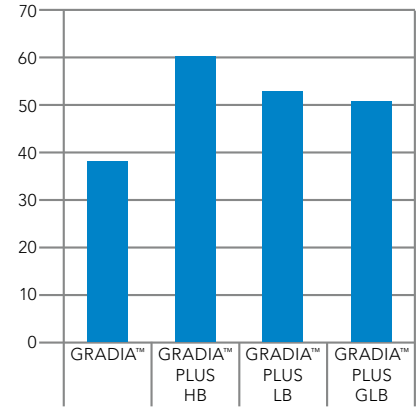
Occlusal Wear (vs bovin's enamel)(μ)
After 200.000 times



Flexural Strength
(MPa)

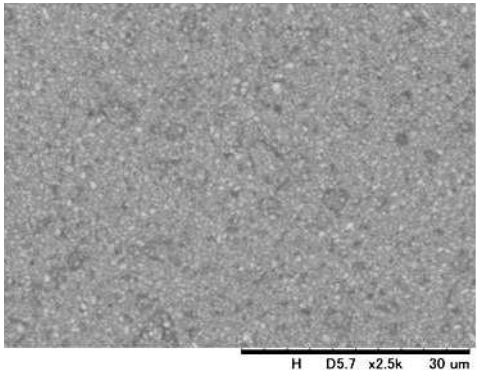


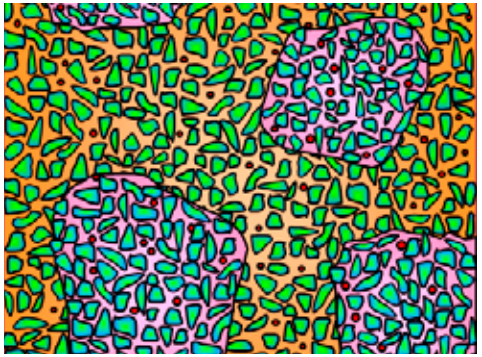
Vickers Hardness
(Hv)



Besides being strong, GC GRADIA™ PLUS is also "gentle" on opposing teeth, making it particularly suitable for posterior high-wear, high-pressure restorations that are prone to chipping or cracking when made with porcelain.

All of this is thanks to GC's nano-filler technology - using high-density and homogeneously dispersed ultra-fine fillers blended into the resin matrix - and it is all achieved just by light-curing.





The ultra-fine fillers are homogeneously dispersed into the resin matrix offering a high-density network

Thanks to a special surface treatment of the ultra-fine fillers the surface properties such as wear resistance and gloss retention are enhanced resulting in high physical properties of all GC GRADIA™ PLUS pastes.

5. Clinical Procedure

CHAIRSIDE

ORAL EXAMINATION

Determine whether GC GRADIA™ PLUS is suitable for the patient.
Check the GC GRADIA™ PLUS indications and contra-indications.
For use only by a dental professional in the recommended indications.

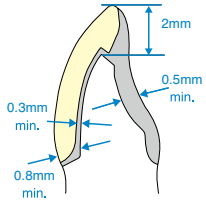
CHAIRSIDE

ABUTMENT TOOTH AND CAVITY PREPARATIONS

Tooth preparation and design of restorations vary according to circumstances.
The instructions for a correct preparation are illustrated below

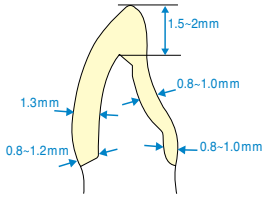
Anterior veneer crown

(With incisal support)
The preparation is similar to a PFM crown. The margins should have a deep chamfer or shoulder with a minimum depth of 0.8mm. Thickness of the metal framework on the labial side should be 0.3mm.



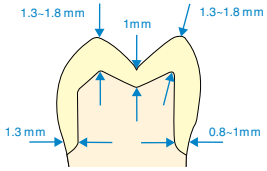
Anterior jacket crown

Prepare the abutment tooth similar to a PFM crown (minimum of 1.3mm labial). Margin design can be a deeper chamfer or shoulder (0.8mm).



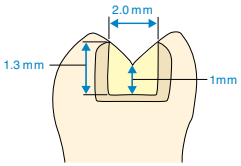
Posterior jacket crown

The occlusal reduction should be at least a 1.3mm. Margins should have 1.3mm depth with a deep chamfer or shoulder.



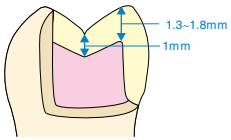
Inlay

Contour the cavity with rounded internal line angles. Avoid contact of the opposing occlusion with the margins of the restoration. The pit and fissure minimum depth should be 1.0mm, the width of the occlusal surface at least 2.0mm with only shoulder margins occlusally. Interproximally, it should be box shaped.



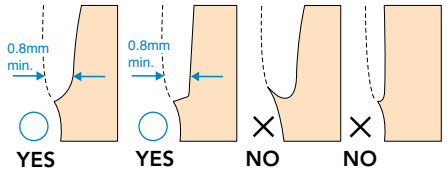
Onlay

Contour the cavity with rounded internal line angles. Avoid contact of the opposing occlusion with the margins of the restoration. Pit and fissure depth minimum should be 1.0mm and cusp at least 1.3mm.



Margin preparations

Prepare deep chamfers [1] or shoulders [2].



CHAIRSIDE

IMPRESSION TAKING

Retract gingiva in the normal manner.
Use a precise vinyl polyether silicone impression material such as GC EXA'lence in combination with GC Impression Trays.

TRAYS

EXA'LENCE

EXAMIX NDS

EXAFLEX

CHAIRSIDE

BITE REGISTRATION AND SHADE RECORDING

Use GC EXABITE II to make the occlusal or bite registration. Determine the preferred shade of the natural tooth after tooth cleaning with the help of a classic V-shade guide. Individual characteristics have to be considered when determining the tooth shade.

EXABITE II NDS

CHAIRSIDE/ LABSIDE

TEMPORARY RESTORATION

Fabricate a temporary restoration with GC Unifast III or GC Revotek LC and cement with a eugenol-free temporary cement such as GC FREEGENOL or GC Fuji TEMP LT.

GC UNIFAST III

GC FujiTEMP LT

GC FREEGENOL

GC Temp PRINT

LABSIDE

POUR AND PREPARE MASTER MODEL

Pour and prepare a working model with a Type IV die stone such as GC FUJIROCK™ EP Classic/Premium Line & GC BASE STONE..

GC FUJIROCK™ EP

GC BASE STONE

PRODUCTION OF THE RESTORATION

CHAIRSIDE PRODUCTION OF THE RESTORATION

See BUILD-UP PROCEDURE.

Labolight DUO

CHAIRSIDE REMOVAL OF THE TEMPORARY RESTORATION AND CLEANING

Remove temporary restoration, sealing material or cement. Clean cavity. Rinse and dry cavity thoroughly.

GC Pliers

CHAIRSIDE TRY IN

Try-in the restoration and check the adaptation using GC Fit Checker Advanced or GC Fit Checker Advanced Blue

CHAIRSIDE CLEANING AND TREATMENT OF THE RESTORATION FOR BONDING

1 primer for all restorations:
Composites, Hybrid Ceramics, Ceramics, Zirconia, Alumina, Non-precious & Precious Alloys, Glass fiber posts

Silane — Bond to glass-ceramics, hybrid ceramics and composite

MDP — Bond to zirconia, alumina and non-precious metals

MDTP — Bond to precious metals

CHAIRSIDE

LUTING PROCEDURES

A variety of GC luting cements can be used with the different indications of GC GRADIA™ PLUS e.g. Fuji Plus, G-CEM LinkAce™, G-CEM LinkForce™.

GC Fuji PLUS

GC FujiCEM® Evolve

G-CEM LinkAce™

G-CEM LinkForce™

G-CEM™ Veneer

	Inlays & onlays				Crowns & bridges				Posts & inlay-cores			Veneers
	Metal	• Feldspathic ceramics • Leucite-reinforced ceramics (e.g. GC Initial LRF)	• Lithium Disilicate (e.g. GC Initial LiSi Press) • Composite (e.g. GRADIA PLUS)	Hybrid ceramics (e.g. CERASMART270)	• Metal (e.g. GC Initial Cast NP) • Zirconia (e.g. GC Initial Zirconia disk) • Alumina	• Feldspathic ceramics • Leucite-reinforced ceramics (e.g. GC Initial LRF)	• Lithium Disilicate (e.g. GC Initial LiSi Press) • Composite (e.g. GRADIA PLUS)	Hybrid ceramics (e.g. CERASMART270)	Metal	Zirconia (e.g. GC Initial Zirconia disk)	Fibre reinforced (e.g. everStickPOST & FIBER POST)	• Feldspathic ceramics • Leucite-reinforced ceramics (e.g. GC Initial LRF) • Lithium Disilicate (e.g. GC Initial LiSi Press) • Hybrid ceramics (e.g. CERASMART270) • Composite (e.g. GRADIA PLUS)
Fuji I Conventional glass ionomer cement	•	-	-	-	•	-	-	-	•	-	-	-
Fuji PLUS Resin-modified glass ionomer cement	•	•	•	-	•	-	•	-	•	•	•	-
FujiCEM 2 SL / FujiCEM Evolve Resin-modified glass ionomer cement		(inlays)										
G-CEM LinkAce Self-adhesive resin cement	•	•	•	-	•	•	•	-	•	•	•	-
G-CEM Self-adhesive resin cement												
G-CEM LinkForce (Dual-cure) Adhesive resin cement	•	•	•	•	•	•	•	•	•	•	•	•
G-CEM Veneer (Light-cure) Adhesive resin cement	-	• *	• *	• *	-	-	-	-	-	-	-	• *

Note: * For indirect restorations with thin thickness (≤ 2mm) that enable the use of a purely light-curing technique.

CHAIRSIDE

ADJUSTING AND POLISHING THE OCCLUSAL SURFACE

Small adjustments like the occlusal surface can be done using a diamond or carborundum point then use silicone points. Finally, use DIAPOLISHER PASTE to obtain a lustrous finish. Alternatively, GC OPTIGLAZE Color Clear can be used.

DIAPOLISHER PASTE

6. Build-Up Procedure

A. OVERVIEW OF GC GRADIA™ PLUS SHADES

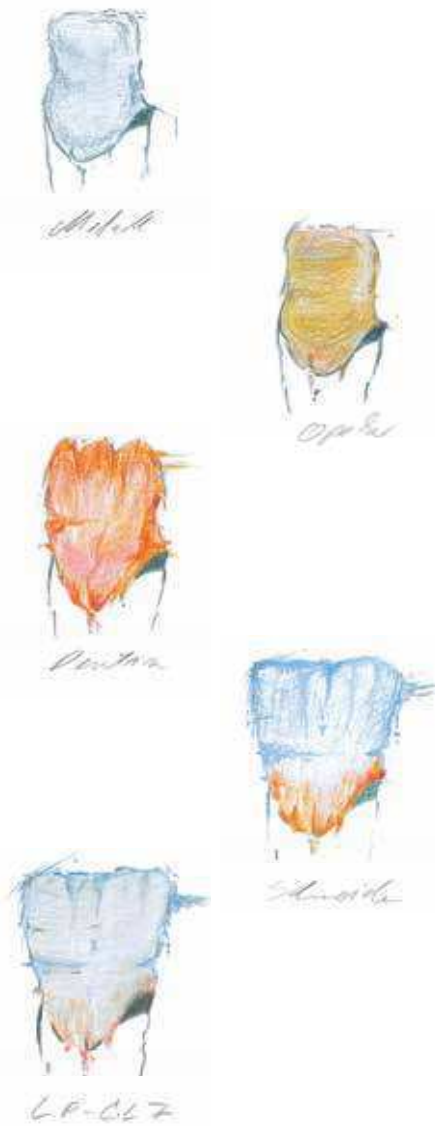
	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4	BW
Opaque*	OA1	OA2	OA3	OA3.5	OA4	OB1	OB2	OB3	OB4	OC1	OC2	OC3	OC4	OD2	OD3	OD4	O-BASE
Dentin	(HB-)DA1	(HB-)DA2	(HB-)DA3	(HB-)DA3.5		(HB-)DB1		(HB-)DB3		(HB-) DB1		(HB-)DC3		(HB-)DD2			(HB-)DW
Opaque Dentin	(HB-)ODA					(HB-)ODB				(HB-)ODC				(HB-)ODD			(HB-)ODW
Cervical (Lustre Paint)	(LP-)CLF, (LP-)A					(LP-)CLF, (LP-)B				(LP-)CLF, (LP-)C				(LP-)CLF, (LP-)D			(LP-)CLF, (LP-)A
Enamel	(HB-)EL		(HB-)ED			(HB-)EL		(HB-)ED		(HB-)EL	(HB-)ED			(HB-)EL	(HB-)ED		(HB-)EL
Effect 1 (Dentin shade)	(LB-)Base D, (LB-)Base OD, (LB-)DW, (LB-)ODW																
Effect 2 (Enamel shade)	(HB-)PE, (LB-)Base E, (LB-)Inlay E																
Effect 3 (Characterize)	(LB-)Base Opal, (LB-)Orange, (LB-)Red, (LB-)Yellow, (LB-)Blue, (LB-)Grey, (LB-)Milky																
Translucent	(HB-)CLF, (LB-)Base CLF,																
Cervical Translucent	(LB-)Inlay TD																
Gum shade	GO-1, GO-2, GLB-1, GLB-2, GLB-3, GLB-CL																
One body	(LB-)A					(LB-)B				(LB-)C				(LB-)D			(LB-)W
Effect 4 (Lustre Paint)	(LP-)Blue, (LP-)Cream, (LP-)Grey, (LP-)Lavender, (LP-)CL, (GLP-)Bright red, (GLP-)Violet																

*See point C. OPAQUE MIXING RATIO page 25.

B. SHADE COMBINATION CHART FOR STANDARD V-SHADE

Although GC GRADIA™ PLUS is based upon fewer standard colors it offers you productivity, flexibility and individuality thanks to its modular concept and the indication related consistency of the different pastes and the possibility to mix Light Body pastes an almost unlimited number of color and texture combinations can be achieved

Classic V-shades	A1	A2	A3	A3.5	A4
Opaque	O-Base : OA	O-Base : OA	O-Base : OA	O-Base : OA	OA
	3 : 1	1 : 1	1 : 2	1 : 3	
Dentin - Paste HB	DA1	DA2	DA3	DA3.5	DA3.5
Enamel - Paste HB	EL	EL	ED	ED	ED
Body & Cervical adjustment Lustre Paint					LP-A
Gloss – Lustre Paint	LP-CLF	LP-CLF	LP-CLF	LP-CLF	LP-CLF
Classic V-shades	**B1**	**B2**	**B3**		**B4**
Opaque	O-Base : OB	O-Base : OB	O-Base : OB		OB
	3 : 1	1 : 1	1 : 3		
Dentin - Paste HB	DB1	DB1	DB3		DB3
Enamel - Paste HB	EL	EL	ED		ED
Body & Cervical adjustment Lustre Paint		LP-B			LP-B
Gloss – Lustre Paint	LP-CLF	LP-CLF	LP-CLF		LP-CLF
Classic V-shades	**C1**	**C2**	**C3**		**C4**
Opaque	O-Base : OC	O-Base : OC	O-Base : OC		OC
	3 : 1	1 : 1	1 : 3		
Dentin - Paste HB	DB1	DB1	DC3		DC3
Enamel - Paste HB	EL	ED	ED		ED
Body & Cervical adjustment Lustre Paint	LP-C	LP-C			LP-C
Gloss – Lustre Paint	LP-CLF	LP-CLF	LP-CLF		LP-CLF
Classic V-shades	**D2**		**D3**		**D4**
Opaque	O-Base : OD		OA OD		OD
	1 : 1		1 : 2		
Dentin - Paste HB	DD2		DD2		DD2
Enamel - Paste HB	EL		ED		ED
Body & Cervical adjustment Lustre Paint			LP-A		LP-D
Gloss – Lustre Paint	LP-CLF		LP-CLF		LP-CLF



C. OPAQUE MIXING RATIO

OA1	OA2	OA3	OA3.5	OA4
O-Base: OA	O-Base: OA	O-Base: OA	O-Base: OA	OA
3:1	1:1	1:2	1:3	
OB1	**OB2**	**OB3**		**OB4**
O-Base:OB	O-Base:OB	O-Base OB		OB
3:1	1:1	1:3		
OC1	**OC2**	**OC3**		**OC4**
O-Base:OC	O-Base:OC	O-Base OC		OC
3:1	1:1	1:3		
OD2		**OD3**		**OD4**
O-Base:OD		OA:OD		OD
1:1		1:2		

Easy dosage of the opaque's O-base and OA (2).

Easy mixing of O-base (1) and OA (2) to create A3 opaque color.
Perfect masking properties of the framework.

D. LAYERING SCHEME FOR STANDARD V-SHADE REPRODUCTIONS

For creating fast and easy the 16 standard V-shades follow the shade combination chart

The combination chart is based upon the use of only a few steps using only few colors.

The opaques will mask and cover perfectly the framework – The dentin allows you to create the body and the enamel the insical part of the crown.

The different Lustre Paint colors can be used to make body and/or cervical adjustments and the Lustre Paint CLF can be used for creating gloss and protection of your realizations (alternative to manual polishing).

MASKING		LAYERING				GLOSS
						
Framework	Opaque	Opaque Dentin Optional Effect	Dentin	CLF Optional Effect	Enamel	Lustre Paint Optional Effect

The following schemes show the simplified layering technique:

Example 1: Reproduction of Standard V-shade A3

- Mix & Mask

OA3

O-BASE: OA

1 : 2

Anatomically designed (Metal) Framework prepared with bonding system

Apply Opaque Mix to cover the (metal) framework

- Layer

Dentin - Paste HB	DA3

Optional Effect Heavy Body Opaque Dentin

Heavy Body Dentin A3

- Layer

Enamel - Paste HB	ED

Optional Effect Heavy Body CLF

Heavy Body Enamel ED

- Paint

Gloss - Lustre Paint	LP-CLF

Body & Cervical adjustment - N.A.
Gloss - Lustre Paint - CLF

Example 2: Reproduction of standard V-Shade A4

- Mix & Mask

OA4

OA

1 : 2

Anatomically designed (Metal) Framework prepared with bonding system

Apply Opaque Mix to cover the (metal) framework

- Layer

Dentin - Paste HB	DA3,5

Optional Effect Heavy Body Opaque Dentin

Heavy Body Dentin A3.5

- Layer

Enamel - Paste HB	ED

Optional Effect Heavy Body CLF

Heavy Body Enamel ED

- Paint

Body & Cervical adjustment - Lustre Paint	LP-A
Gloss - Lustre Paint	LP-CLF

Body & Cervical adjustment - LP-A
Gloss - Lustre Paint - CLF

E. SIMPLIFIED TECHNIQUE: PAINT COLOR AND GLOSS

1. EXTERNAL CHARACTERIZATION AND COATING BY USING LUSTRE PAINT

1.1 Gloss

GC GRADIA™ PLUS veneered crown A3. Finished and contoured using dedicated tungsten and diamond burs.
Sandblast the surface (1,5bar, 50mμ)

Apply CERAMIC PRIMER II to the sandblasted surface and allow to dry.

For external characterization (coating) Lustre Paint should always be diluted using the dedicated Lustre Paint Diluting Liquid.
By diluting the Lustre Paint you can create your own preferred consistency.

Apply a thin layer of diluted LP-CLF onto the surface and light-cure.*

Final result of the GC GRADIA™ PLUS restoration with perfect gloss and color match.

*for irradiation time and light-curing units we refer to page 29.

1.2 Characterization and gloss

This GC GRADIA™ PLUS crown has been build up following the GC GRADIA™ PLUS Shade Combination Chart for Standard V-shades.
In this example we will be creating an A4 color from starting point A3,5.

GC GRADIA™ PLUS veneered crown B3.
Finished and contoured using dedicated tungsten and diamond burs. Sandblast the surface (1,5bar, 50mμ)

Apply CERAMIC PRIMER II to the sandblasted surface and allow to dry.
For external characterization GC GRADIA™ PLUS Lustre Paints should always be diluted using the dedicated Lustre Paint Diluting Liquid.
By diluting the Lustre Paint you can create your own preferred consistency.

By applying LP-A, the chroma can be easily increased.
Light-cure*

For final glaze, apply a thin layer of diluted LP-CLF onto the surface and light-cure*

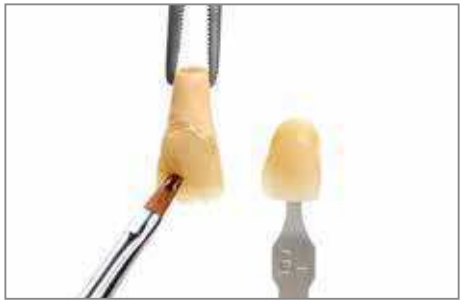
Final result of the GC GRADIA™ PLUS restoration with external characterization and gloss.

*for irradiation time and light-curing units we refer to page 29.

2. INTERNAL CHARACTERIZATION BY USING LUSTRE PAINT

This GC GRADIA™ PLUS Crown has been build up following the GC GRADIA™ PLUS Shade Combination Chart for Standard V-shades.
In this example we will be creating a B4 color from starting point B3.

Apply CERAMIC PRIMER II to the sandblasted surface and allow to dry.



For internal characterization GC GRADIA™ PLUS Lustre Paints can be used pure or diluted using the dedicated Lustre Paint Diluting Liquid. By applying LP-B, the chroma can be easily increased. Shade check can easily be done with a dedicated shade tab, if required adjustments can be done. Light-cure.*

Use HB-ED to layer enamel and contour the final shape.
Optional effect: a very thin layer of CLF (HB or LB) can be applied inbetween the dentin core and the enamel.
Light-cure*. Finishing and contouring using dedicated tungsten and diamond burs.

Creating gloss: follow protocol above under 1.1.

*for irradiation time and light-curing units we refer to page 29.

F. GC GRADIA™ PLUS – LIGHT-CURING

Approved light-curing devices

- Labolight DUO (GC)
- Labolight LV-III / Steplight SL-I (GC)

Irradiation time and curing unit				
Curing unit	Labolight DUO		STEPLIGHT SL-I	Labolight LV-III,II
	Step-mode**	Full-mode	Pre-Cure**	Final cure
OPAQUE	–	1 min.	–	1 min.
PASTE HB, PASTE LB, GUM SHADES LB, GUM SHADES HB	10 sec.*	3 min.	10 sec.*	3 min
LUSTRE PAINT ***	10 sec.	90 sec.	10 sec.*	5 min

* For one surface of a single crown.
** Distance from light source: 3 cm.
*** Thickness: 0,1 mm or less.

When only the best aesthetics will do

Meeting all aesthetic requirements is of paramount importance in today's dentistry. With the new GC GRADIA™ PLUS system from GC, you will be able to closely match any oral situation: both the white and the red, in the anterior and posterior region, from single crowns to full rehabilitations.

The GC GRADIA™ PLUS system encompasses all you need from the start, to create brightness, translucency, chroma and a natural opalescence in the oral environment similar to porcelain.

7. Step-by-step

7.1 METAL BASED RESTORATIONS

BUILD UP PROCEDURE FOR METAL SUPPORTED CROWN / STANDARD V-SHADE
For irradiation time and light-curing units we refer to page 29.

1. Production of metal framework

Wax up framework conventionally, make sure the framework has an anatomical design, supporting the GC GRADIA™ PLUS composite. Respect minimal thicknesses. Apply retention beads to the to be veneered surfaces.

Cast in the usual manner.

Sandblast the metal frame. Clean and dry with air gun.
Immediately apply METAL PRIMER Z to the to be veneered surfaces and allow to dry.

2. Build up procedure

Immediately apply a layer of OPAQUE and light-cure for 1 minute.

Repeat this process until the metal color is masked out.

Tip: For easy application of the opaque, block out the retentive areas applying LB-Base CLF and light-cure for one minute.

Dentin
Apply Dentin shades[1, 2], building up to the desired thickness. Pre-cure.

Enamel:
Apply enamel progressively from incisal to cervical creating the final shape of the crown. Light-cure.
Apply GC GRADIA™ PLUS AIR BARRIER on the surface and light-cure for 3 minutes.
Remove GC GRADIA™ PLUS AIR BARRIER with water.

[1] Processing aid like MODELING LIQUID can be used. See page 12.
[2] Depending on shade or internal characterization, Lustre Paint can be used. See page 22.

3. Shaping

Adjust contour and shape surface with dedicated tungsten and diamond burs.

4. Gloss (coating or polishing method)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50mμ)
- Immediately apply CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE METAL SUPPORTED IMPLANT BRIDGE / POLYCHROMATIC LAYERING

For irradiation time and light-curing units we refer to page 29.

1. Production of metal framework



Design, cast and prepare the metal framework according to the general guidelines for metal supported bridgeworks.

Sandblast the metal frame, clean and dry with air gun.
Immediately apply METAL PRIMER Z to the to be veneered surfaces and allow to dry.

2. Build up procedure



Immediately apply a layer of opaque and light-cure for 1 minute.
Repeat this process until the metal color is masked out.

Tip: Opaque O-Base can be used as a wash opaque.

Gingival areas can be covered with gum opaque GO-1 and/or GO-2.
Light-cure.

Tip: Different opaque shades can be used.



Dentin
Apply Dentin shades[1,2], building up to the desired thickness. Pre-cure.
Cover the entire body with a thin layer of the fluorescent transpa material CLF (LB or HB). This will create the effect of depth. Light-cure.

Tip: Shaping of the mamelon structure in the dentine can be done using an instrument or a brush.

1 Processing aid like MODELING LIQUID can be used. See page 12.
2 Depending on shade or internal characterization, lustre paint can be used. See page 29.

To increase chroma on the palatinal side, effect shades can be used.
e.g. LB-Orange, LB-Red, etc.
Light-cure.

Complete the anatomical design using Dentin / Enamel / Effect.
Internal characterization can be done by using Lustre Paint. Light-cure.

Incisal effects can be achieved by using light body effect shades.
e.g. LB-Opal, LB-Grey, LB-Blue, etc.
Light-cure.

The final shape is formed using enamel shades.
Light-cure.

Tip: Use a darker shade in between the roots and a lighter shade to imitate the root.
Use the Gum Lustre Paints for extra individualization and characterization.
e.g. veins, natural pigmentation, etc.

Use heavy body gum shade to create volume in the gingival area. Use light body gum shades to obtain effects and smooth transition. For depth effect, apply translucent shade CL to the surface (GLB or GHB). Apply GC GRADIA™ PLUS AIR BARRIER on the surface and light-cure for 3 minutes. Remove GC GRADIA™ PLUS AIR BARRIER with water.

3. Shaping

Adjust contour and shape surface with diamond and tungsten burs. (see previous)

4. Gloss (coating or polishing method)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50µ)
- Immediately apply CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE FOR ONE BODY FLASK TECHNIQUE

For irradiation time and light-curing units we refer to page 29.

1. Production of metal framework

We refer to metal based restorations for the production of the metal framework.

2. Apply and light-cure opaque

For applying the opaque onto the metal framework, we refer to metal based restorations.

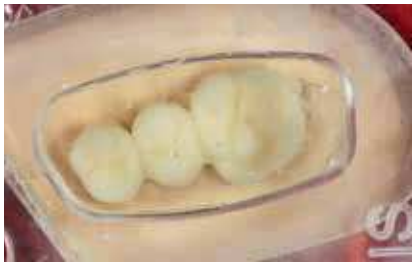
3. Flask preparation

GC GRADIA™ PLUS One Body pastes can be easily used to inject or press into a transparent mold.

Please use a hard silicone to avoid deformations. For an optimal result the matrix material should be completely transparent to obtain perfect light transmission.

Fit check the metal structure on the model.

4. Injecting and light-curing the GC GRADIA™ PLUS One Body LB shades



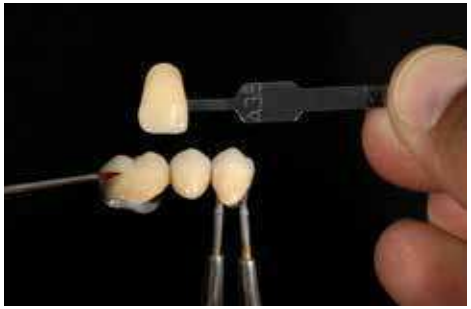
Inject or press the GC GRADIA™ PLUS Light Body into the mold.

Tip: LB-Base OD can be used to cover thin or basal areas.

Place the flask in in the Labolight DUO and light-cure.

Remove the restoration from the silicone matrix.
Apply GC GRADIA™ PLUS AIR BARRIER on the surface and light-cure for 3 minutes.
Remove GC GRADIA™ PLUS AIR BARRIER with water.

5. Gloss, characterization and individualization using GC GRADIA™ PLUS Lustre Paints



Sandblast the surface (1.5 bar, 50µ) and immediately apply CERAMIC PRIMER II to the surface and let dry. Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.
Characterize and individualize the restoration by using the GC GRADIA™ PLUS Lustre Paints. Lustre Paints should be diluted using the dedicated Diluting Liquid.

INJECTION TECHNIQUE
For irradiation time and light-curing units we refer to page 29.

1. Model preparation

A gypsum model with implant analogues has been casted using GC FUJIROCK™ EP.

EXACLEAR, clear vinyl polysiloxane is used as gingiva mask. This will allow us to photopolymerise the basal part of the injected GRADIA™ PLUS composite.

For the prosthetic part an Aadva® SR abutment with Ø4.8 was chosen.

2. Digital design

After scanning the model in the Aadva® Lab Scan, a full anatomical, digital mock-up is designed and printed with GC Temp PRINT™.

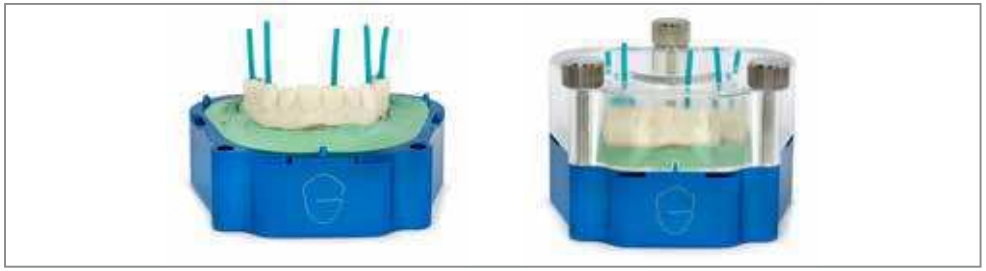
The printed mock-up is fitted onto the model. If required, GC Temp PRINT™ can be individualised using OPTIGLAZE® color and used as a long–term provisional.

The anatomical design of the mock-up was digitally reduced and milled in titanium.

3. Flask preparation

The mock-up is screwed onto the model and placed into a flask. Screwholes are then sealed with a bit of wax and the model is fixed into the flask with putty.

Tip: before sealing the screwholes with wax, push a clot of teflon into the access hole.



Fix the sprues onto the mock-up and carefully check their position with the top of the flask onto it. The sprues should be postioned in the middle of the hole.

Tip: Ideally a sprue of Ø3.0 is used, as this diameter corresponds with the sprue of the GRADIA™ PLUS light body syringe.

A clear silicone is used to fill the entire flask. For easy removal of the top part after curing, coat the putty surface first with a bit of vaseline or a dedicated separator. Remove the wax sprues and clean the injection channels thoroughly.

4. Framework preparation

After milling, the titanium framework is prepared, sandblasted and cleaned.

METAL PRIMER Z is applied on the surface and let to dry.

A first, thin layer of opaque is applied and light cured for 1 minute. Repeat this process until the metal is completely masked.

For extra individualisation, darker or lighter shades of opaque can be applied.
Light cure.

Cervical and occlusal areas are covered with small amounts of LB-orange to create a warm, in-depth effect.
Light cure.

Screw the framework on the model, push a clot of telfon in the screwholes and seal with wax.

5. Injection procedure

Check carefully if all wax residue from the sprues was removed. Light Body A can then be injected into the mold. Let the composite flow from sprue to sprue until it gently comes out. Place a finger onto the channels and slightly apply pressure.

With diamond and tungsten burs, a cut-back is performed on the anterior teeth.

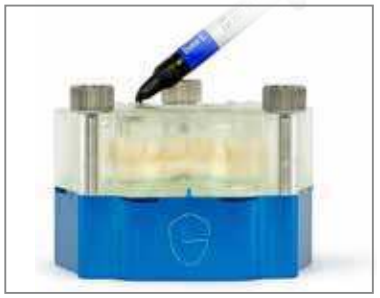
Tip: When the silicone mould is completely filled with composite, leave for 5 minutes in a dark place. This eliminates the dimensional deformations caused by the pressure of injection and will allow the clear silicone to return to it's original position.

Apply CERAMIC PRIMER II on the surface.

Internal characterization of the anterior teeth is carried out with LB-Yellow for the mamelons, LB-Milky for the proximal ridges, LB-Base Opal in between the mamelons and Base-CLF for the dentin-enamel junction.
Light cure.

Place the model back in the flask, close the screwholes with teflon and wax and carefully screw the top part back on the flask. Check perfect positioning.

Tip: Cut the putty in straight cuts with a sharp knife for easy repositioning in the flask.



LB-Base E is used to inject the enamel part and light-cured afterwards.

Unscrew the top part of the flask and remove the sprues with a diamond disk.

Remove wax and teflon from the screwholes and unscrew the restoration.

Thanks to transparancy of EXACLEAR, also the basal area is fully cured.

6. Gingival reproduction

Adjust contour and shape with diamond and tungsten burs.

Prepare the gingival area with dedicated burs and apply CERAMIC PRIMER II.

Gingival anatomy is reproduced using Gum Heavy Body shades for creating volume and Gum Light Body shades for characterization.

Tip: for easy application , a small layer or Light Body is applied first on the surface.

Small details, such as the labial frenulum, can be easily made with a Gum Light Body shade.

Tip: for a life-like and natural appearance, try not to grind gingival area.

A combination of Gum Light Body shades is used to cover the lingual area.

After step-curing, cover the entire area with GRADIA™ PLUS AIR BARRIER and lightcure in Labolight DUO for 3 minutes.

GRADIA PLUS Gum Shades Set

7. Gloss & characterization (coating method)

Gloss and characterization can be done using the GRADIA™ PLUS Lustre Paints.

- Sandblast (1.5 bar, 50mμ)
- Immediately apply CERAMIC PRIMER II to the surface and let dry.

For external characterization GC GRADIA™ PLUS Lustre Paints should always be diluted using the dedicated Lustre Paint Diluting Liquid. By diluting the Lustre Paint you can create your own preferred consistency.
Light cure.

8. Final result

7.2 METAL FREE RESTORATIONS

LUSTRE PAINT ON CERASMART™270 ANTERIOR
For irradiation time and light-curing units we refer to page 29.

1. Preparation of the Cerasmart coping

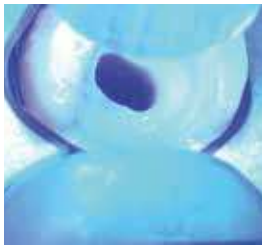
Sandblast the coping with aluminum oxide (25-50µ ; 0,2 MPa)
Clean with oil-free air syringe or ultrasonic cleaner.
Clean further with alcohol.
Apply CERAMIC PRIMER II and let dry.

2. Gloss, characterization and individualization using GC GRADIA™ PLUS Lustre Paints

Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.
e.g. LP-body in the cervical area up to 2/3 of the body area.

IMPORTANT
For external usage, GC GRADIA™ PLUS Lustre Paint should always be diluted using the Diluting Liquid.

Tip: To prevent contamination, wash the brush with Lustre Paint Diluting Liquid every time.



e.g.
LP-Blue for opalescent appearance in the incisal area.
LP-Cream for whitish discolorations / staining on tooth surface.
LP-Grey can be used for mamelon structure effects.

Light-cure.

Finalize by applying a thin layer (<0.1mm) of Lustre Paint LP-CLF over surface and final-cure.

LUSTRE PAINT ON CERASMART™270 POSTERIOR

For irradiation time and light-curing units we refer to page 29.

1. Preparation

Sandblast the coping with aluminum oxide (25-50µ ; 0,2 MPa).
Clean with oil-free air syringe or ultrasonic cleaner.
Clean further with alcohol.
Apply CERAMIC PRIMER II and let dry.

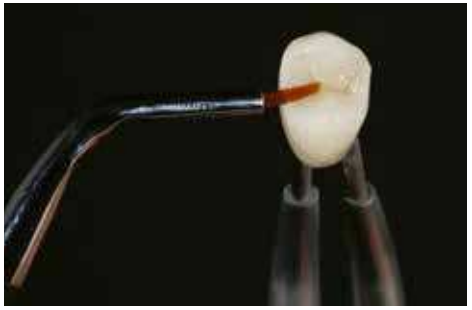
2. Gloss, characterization and individualization using GC GRADIA™ PLUS Lustre Paints

Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

e.g. LP-body in the cervical area up to 2/3 of the body area and in fissures and pits for occlusal characterization.

Tip: To prevent contamination, wash the brush with Lustre Paint Diluting Liquid every time.

Finalize by applying a thin layer (<0.1mm) of Lustre Paint LP-CLF over surface and final-cure.



IMPORTANT
For external usage, GC GRADIA™ PLUS Lustre Paint should always be diluted using the Diluting Liquid.

BUILD UP PROCEDURE FOR CERASMART™270 CUTBACK COPING

For irradiation time and light-curing units we refer to page 29.

1. Preparation of the Cerasmart coping

Sandblast the coping with aluminum oxide (25-50µ ; 0,2 MPa).
Clean with oil-free air syringe or ultrasonic cleaner.
Clean further with alcohol.
Apply CERAMIC PRIMER II and let dry.

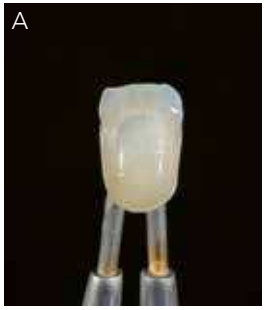
2. Characterization and build up

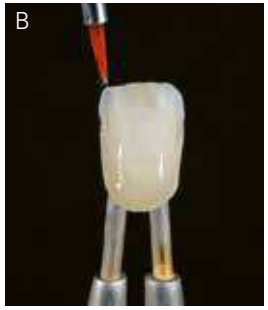
Internal characterization with GC GRADIA™ PLUS Lustre Paint.

IMPORTANT
For internal usage, GC GRADIA™ PLUS Lustre Paint can be used pure or diluted using the Diluting Liquid.

Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

Build up with GC GRADIA™ PLUS hybrid composite.

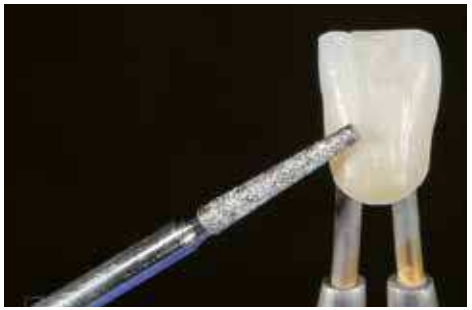




A. To add extra effect in the incisal area, use GC GRADIA™ PLUS Light Body. e.g. LB-Base Opal
B. Slight effects can be done with Lustre Paints. e.g. LP-Cream for whitish discolorations in the incisal area
C. Apply enamel (Heavy Body or Light Body) progressively from incisal to cervical creating the final shape of the crown.

Tip: To prevent contamination, wash the brush with Lustre Paint Diluting Liquid every time.

3. Shaping



Adjust contour and shape surface with diamond and tungsten burs.

4. Gloss (Coating and polishing)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50µ)
- Immediately CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

IMPORTANT
For internal usage, GC GRADIA™ PLUS Lustre Paint can be used pure or diluted using the Diluting Liquid.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE FOR INLAY

For irradiation time and light-curing units we refer to page 29.

1. Model Preparation

Pour the model using GC FUJIROCK™ EP and prepare the dies.
Coat dies with GC GRADIA™ DIE HARDNER.
Block out undercuts with wax.
Coat cavity with GC GRADIA™ SEPARATOR.

2. Build up procedure

Dentin Gradually fill up the cavity using LB-Inlay TD. Natural tooth color will show through.

Tip: If tooth is discolored, first apply thin layer of opaque or LB-Base OD.

Enamel create the final occlusal shape with LB-Inlay E and/or effect shades. Lustre Paints can be used for internal effects and discolorations. Light-cure.

Tip: For occlusal modeling, use a brush or eject the light body directly from the syringe.

Coat surface with GC GRADIA™ PLUS AIR BARRIER to eliminate air inhibition layer.
Final light-cure 3 minutes.
Remove GC GRADIA™ PLUS AIR BARRIER with water.

3. Shaping

Adjust contour and shape surface with diamond and tungsten burs.

4. Gloss (Coating or polishing method)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50µ).
- Immediately CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure. Please remind diluting the Lustre Paint.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE FOR ANTERIOR JACKET CROWN

For irradiation time and light-curing units we refer to page 29.

1. Model preparation

Pour out the impression with GC FUJIROCK™ EP and prepare the dies.
Coat dies with GC GRADIA™ PLUS DIE HARDNER. If needed, add wax as cement spacer.
Apply a thin coat of GC GRADIA™ PLUS SEPARATOR.

Tip: To mask a discolored tooth, cover the surface with a thin layer of opaque.

2. Build up procedure

Dentin

To create natural variations of brightness in the dentin, apply an opaque dentin in the cervical area.
Apply Dentin shades[1, 2], building up to the desired thickness and pre-cure.

Tip: Shaping of the mamelon structure in the dentine can be done using an instrument or a brush.

Enamel

Apply a thin layer of CLF (HB-CLF or LB-Base CLF) over the dentin and in between the mamelons. This will create the effect of depth.

Create the final shape of the crown with enamels and/or effect shades.
Light-cure.

[1] Processing aid like MODELING LIQUID can be used. See page 12.
[2] Depending on shade or internal characterization, lustre paint can be used. See page 29.

Complete lingual surface and proximal areas. Slightly over contour proximal surfaces to allow grinding and polishing. Light-cure.
Coat surface with GC GRADIA™ AIR BARRIER to eliminate air inhibition layer and to guarantee complete polymerization. Light-cure for 3 minutes.
Remove GC GRADIA™ PLUS AIR BARRIER with water.

3. Shaping

Adjust contour and shape surface with diamond and tungsten burs.

4. Gloss (Coating and polishing)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50µ).
- Immediately CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure. Please remind diluting the Lustre Paint.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE FOR POSTERIOR JACKET CROWN

For irradiation time and light-curing units we refer to page 29.

1. Model preparation

Pour out the impression with GC FUJIROCK™ EP and prepare the dies.
Coat dies with GC GRADIA™ PLUS DIE HARDNER.
If needed, add wax as cement spacer.
Apply a thin coat of GC GRADIA™ PLUS SEPARATOR.

Tip: To mask a discolored tooth, cover the surface with a thin layer of opaque.

2. Build up procedure

Dentin

To create natural variations of brightness in the dentin, apply an opaque dentin in the cervical area.
Apply dentin shades[1,2], building up to the desired thickness and pre-cure.
Apply a thin layer of CLF (HB-CLF or LB-Base CLF) over the dentin and in between the mamelons. This will create the effect of depth.

Enamel

Internal characterization, pits and fissures or chroma adjustments can be done using the Lustre Paints.
Creating the final shape of the crown with enamels and/or effect shades.
Light-cure.
Apply GC GRADIA™ PLUS AIR BARRIER on the surface and light-cure for 3 minutes.
Wash of GC GRADIA™ PLUS AIR BARRIER with water.

[1] Processing aid like MODELING LIQUID can be used. See page 12.
[2] Depending on shade or internal characterization, lustre paint can be used. See page 29.

3. Shaping

Adjust contour and shape surface with diamond and tungsten burs.

4. Gloss (Coating and polishing)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50µ).
- Immediately apply CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure. Please remind diluting the Lustre Paint.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations. See metal free jacket anterior for full procedure. See page 29.

BUILD UP PROCEDURE FOR FACING

For irradiation time and light-curing units we refer to page 29.

1. Model Preparation

Prepare GC FUJIROCK™ EP dies.
Coat dies with GC GRADIA™ PLUS DIE HARDNER.
If needed, add wax as cement spacer
Apply thin coat of GC GRADIA™ PLUS SEPARATOR.

Tip: To mask discolored natural tooth, cover the surface with a thin layer of opaque.

2. Build up procedure

Dentin
Apply Dentin shades[1, 2], building up to the desired thickness.
Pre-cure.

Tip: Shaping of the mamelon structure in the dentine can be done using an instrument or a brush.

Cover the entire body with a thin layer of the fluorescent transpa material CLF (LB or HB). This will create the effect of depth.
Light-cure.

Enamel
Apply enamel progressively from incisal to cervical creating the final shape of the crown.
Light-cure.

Apply GC GRADIA™ PLUS AIR BARRIER on the surface and light-cure for 3 minutes.
Remove GC GRADIA™ PLUS AIR BARRIER with water.

[1] Processing aid like MODELING LIQUID can be used. See page 12.
[2] Depending on shade or internal characterization, lustre paint can be used. See page 29.

3. Finishing

Adjust contour and shape surface with diamond and tungsten burs.
See previous.

4. Gloss (coating or polishing method)

4.1. Coating method using Lustre Paint

- Sandblast (1.5 bar, 50mμ).
- Immediately apply CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

4.2 Polishing method

Finish and polish using standard tools and procedures for composite restorations.

BUILD UP PROCEDURE FOR ONE BODY FIBRE REINFORCED CROWN OR BRIDGE

For irradiation time and light-curing units we refer to page 29.

1. Design of fibre reinforcement using everStick™C&B & Preparation of the matrix material

See instructions for use of StickTech for the design of the fibre reinforcement.
Please use a hard silicone to avoid deformations. For an optimal result the matrix material should be completely transparent for perfect light transmission.

2. Injecting and light-curing of the GC GRADIA™ PLUS One Body LB shades

Inject or press the GC GRADIA™ PLUS LIGHT BODY into the matrix material. Light-cure

Tip: LB-Base OD can be used to cover thin or basal areas.

Coat surface with GC GRADIA™ PLUS AIR BARRIER to eliminate air inhibition layer and to guarantee complete polymerization. Light-cure for 3 minutes.

Remove GC GRADIA™ PLUS AIR BARRIER with water.

3. Gloss, characterization and individualization using GC GRADIA™ PLUS Lustre Paints

Characterize and individualize the restoration by using the GC GRADIA™ PLUS Lustre Paints.

Important: Lustre Paints should be diluted using the Diluting Liquid for external use.

7.3 DENTURE

INDIVIDUALIZATION/CHARACTERIZATION OF ACRYCLIC BASED DENTURE

For irradiation time and light-curing units we refer to page 29.

1. Preparation of acrylic denture



Roughen acrylic surface by sandblasting with aluminum oxide (50µm, 0,2mpa) or by roughening with tungsten burs. Provide enough space in the cutback for layering.
Clean the surface by steam cleaner or clean with oil free air. The prepared surface should not be touched anymore.
Dispose a few drops of GC Acrylic Primer into a dispensing dish.
Wet the area (e.g. tooth area) with GC Acrylic Primer by using a brush and light-cure.
Make sure GC Acrylic Primer is applied over the entire surface.

2. Build up procedure

2.1. building up tooth structures


Apply a thin layer of LB-Base CLF onto the dentin area to imitate sclerotic dentin.
This will create depth.
Light-cure.
Create mesial and distal edges with enamel, e.g. HB-PE, and light-cure.


Internal characterizations can be made using Lustre Paint or Light Body and light-cure.
E.g. LP-Cream for small internal decalcification spots.
LB-Yellow is used to create a mamelon structure.
Apply enamel progressively from incisal to cervical creating the final shape of the crown. Light-cure.

2.2. building up gingiva structures

Roughen gum area by sandblasting with aluminum oxide (50µm, 0,2mpa) or by roughening with tungsten burs.

Apply GC Acrylic Primer and light-cure.

GLB-3 is applied in the cervical area and the root zone.

Tip: Avoid making pronounced lines, let the borders fade out in blurry lines.

GLB-2 and GLB-3 are mixed (50:50) and applied in the areas in between the roots with a brush. Light-cure.

A thin layer of GLB-1 covers this area to give the effect of depth. Light-cure.

Lustre Paint GLP-Bright Red is applied where the alveolar groove starts. Alveolar groove is completed with GLP-Violet. Light-cure.

Veins can be imitated by using LP-Blue.

Cover the area with LB-CL, small anatomical details can be corrected with HB-CL or LB-CL. Light-cure.

Apply GC GRADIA™ PLUS AIR BARRIER with a brush and light-cure for 3 minutes for final polymerization.

Remove GC GRADIA™ PLUS AIR BARRIER with water.

3. Shaping

Adjust contour and shape surface with diamond and tungsten burs.

4. Gloss (coating or polishing method)

4.1 Coating method using Lustre Paint

- Sandblast (1.5 bar, 50mμ).
- Immediately apply CERAMIC PRIMER II to the surface and let dry.
- Apply a thin layer (<0.1mm) of Lustre Paint over the surface and light-cure.

4.2 Polishing method

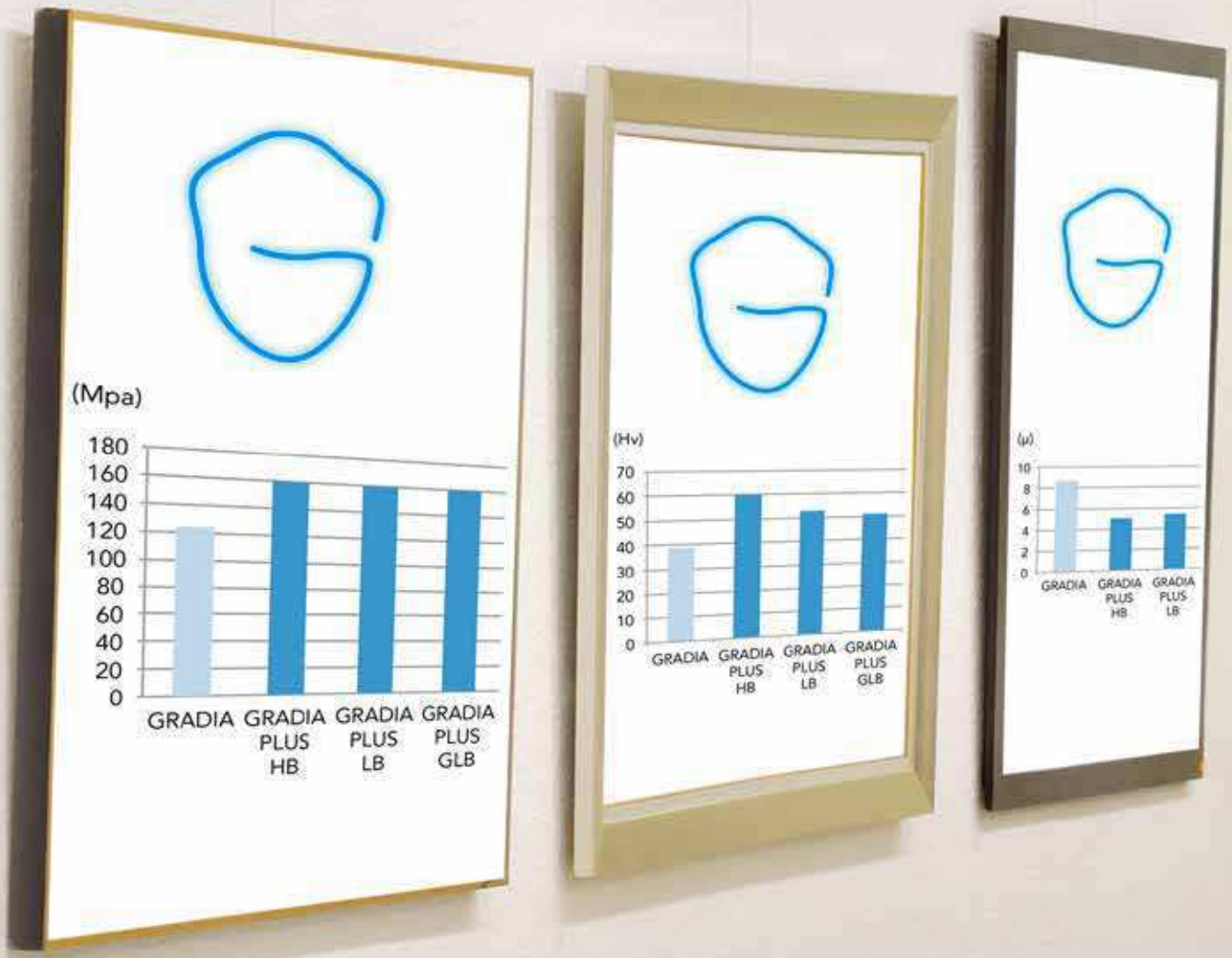
Finish and polish using standard tools and procedures for composite restorations.

IMPORTANT
For external usage, GC GRADIA™ PLUS Lustre Paint should always be diluted using the Diluting Liquid.

Tip: LP-CL for gingivastructures, LP-CLF for tooth structures.

Regardless of your preferred approach - Layering or One Body - with GC GRADIA™ PLUS you can complete a wide range of clinical applications, from metal-free inlays, veneers and jacket crowns to frame-supported crowns and bridges and implant superstructures … always achieving a highly aesthetical "red and white" reproduction.

GC GRADIA™ PLUS from GC – where white and red are in perfect harmony


(Mpa)
180
160
140
120
100
80
60
40
20
0
GRADIA
GRADIA PLUS HB
GRADIA PLUS LB
GRADIA PLUS GLB

(Hv)
70
60
50
40
30
20
10
0
GRADIA
GRADIA PLUS HB
GRADIA PLUS LB
GRADIA PLUS GLB

(μ)
10
8
6
4
2
0
GRADIA
GRADIA PLUS HB
GRADIA PLUS LB

8. Studies / Physical properties

COMPOSITE WEAR RESISTANCE OF NEW INDIRECT COMPOSITE

Study by H. Kato, D. Machida, T. Ueno, T. Kumagai (Research & Development Department, GC Corp., Tokyo, Japan)
Presented during EPA: European Prosthodontic Association, Halle, Germany, 2016, 9/15-17

1. Abstract

A new indirect composite system has been developed:
GC GRADIA™ PLUS LB (Light Body, flowable type) / HB (Heavy Body, paste type) (Fig. 1).
GC GRADIA™ PLUS overcomes weaknesses of Micro-Filled Resin (MFR) by adopting nano-filler technology, the same as G-ænial Universal Flo (GC) and CERASMART™ (GC). All demonstrate high gloss retention and high mechanical properties.

2. Study purpose

Evaluate the wear resistance of GC GRADIA™ PLUS and other indirect composites against an enamel antagonist after a three-body wear test.

3. Materials

Code / Material	Manufacturer	Lot No.	Glass filler size
GPL / GC GRADIA™ PLUS LB*	GC	1506191G	300nm
GPH / GC GRADIA™ PLUS HB*	GC	1506201G	300nm
GR / GC GRADIA™	GC	1411101	1μm
CRM / CERAMAGE	Shofu	031546	1-6μm
SC / Signum Ceramics	Heraeus Kulzer	010205A	0.6-1μm
CLF / crea.lign flow	Bredent	N144514	40nm
CLP / crea.lign paste	Bredent	144309	40nm
NP / SR nexco paste	Ivoclar/Vivadent	T20056	10-50nm

* LB: Light Body (flowable type) / HB: Heavy Body (paste type)
Specimens of each indirect composite were formed for each material using a metal mold and cured according to the manufacturer's instructions for use.

4. Methods

Flow chart of wear test

Specimens were prepared with 1000-grid SiC paper

Bovine enamel was prepared with 4000-grid SiC paper

Stored in 37°C water for 24h(TC0), or under thermal cycling (5-55°C for 10,000 cycles)(TC10000).

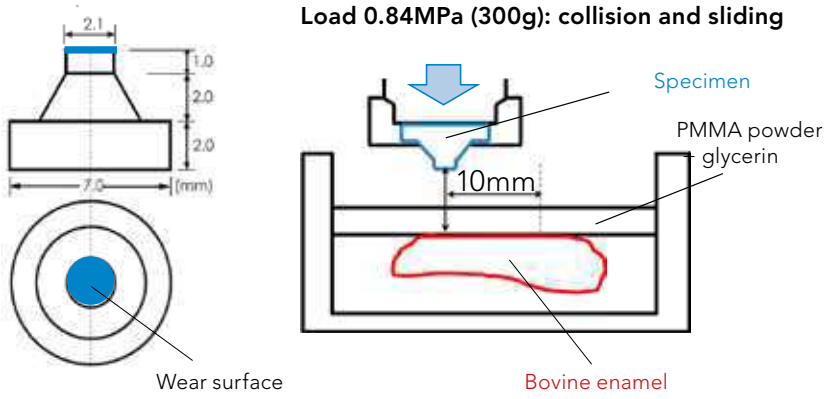
Performed three-body wear test for 100,000 cycles (load 0.84 MPa, n=4) (Fig.2)

- Calculated wear value from a difference of specimen height, before and after wear test. (Fig.3a)
- Observed wear surface with electron microscope (SEM, SU-70, HITACHI) (Fig.4)

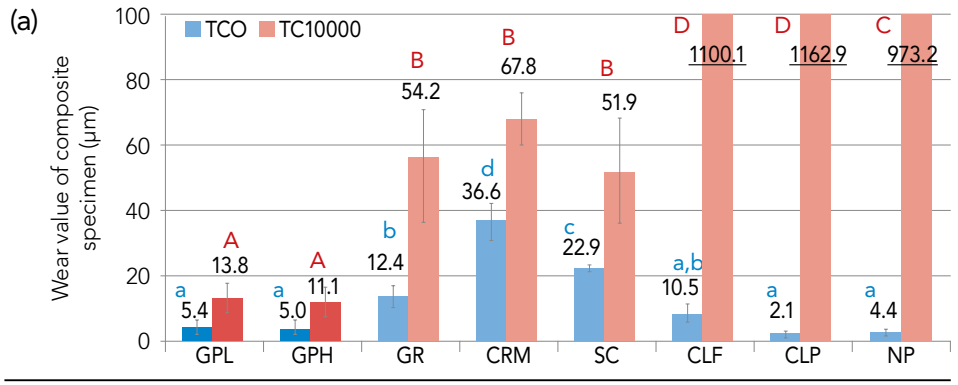
Measured wear value with 3D Measurement Macroscope (VR-3100, KEYENCE) (Fig.3b)

Results were statistically analyzed by one-way ANOVA ($p<0.05$).

Fig. 2 Shape of specimen (left) and diagram of three-body wear test (right)



5. Results and Discussion



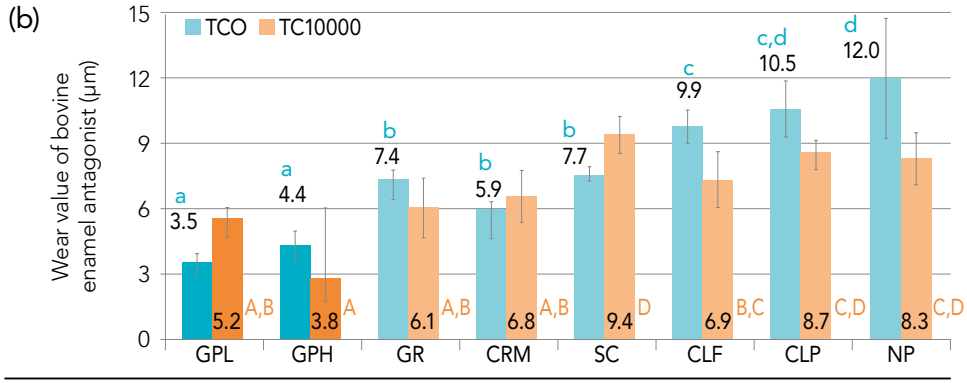


Fig.3 Wear value of composite specimen (a), and bovine enamel antagonist (b). Same superscript indicates no statistically difference.

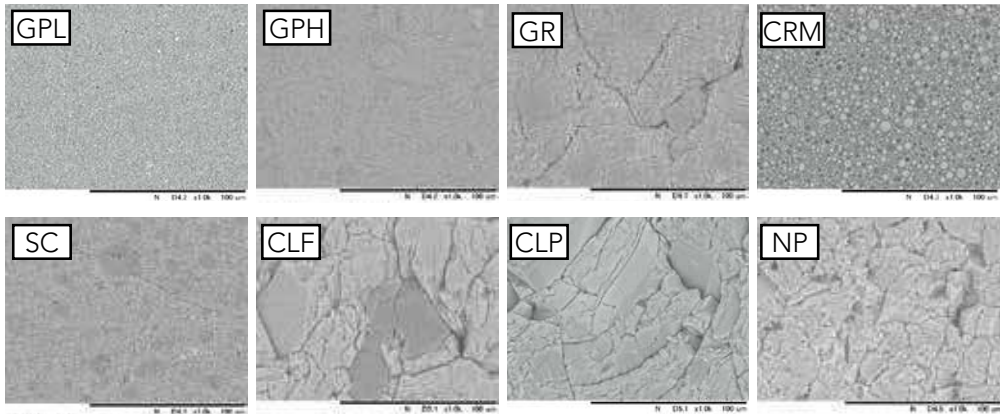


Fig. 4
Wear surface of indirect composite specimens after thermal cycling and three-body wear test.

GPL and GPH exhibited significantly lower wear value of specimen (Fig.3a) and bovine enamel antagonist (Fig.3b) compared to the other indirect composite before and after thermal cycling. Wear surface of GPL and GPH were smooth after thermal cycling and wear test. In contrast, CLF, CLP and NP had totally damaged and cracked wear surface (Fig.4).

Glass filler size of GPL and GPH is ultra fine. However GR, CRM and SC contain micro size glass filler (Table1), and CLF, CLP and NP contain larger pre- polymerized filler. This may indicate that these larger filler is caused higher wear value of enamel antagonist.

In addition, pre-polymerized filler Is difficult to be treated by a silane coupling agent due to lower filler content. Therefore crack was generated from interface between pre-polymerized filler and resin matrix by stress of expansion/contraction of filler during thermal cycling in CLF, CLP and NP. However, GPL and GPH were not much affected by thermal cycling, due to ultra fine filler of these products was most suitably treated by a silane coupling agent.

6. Conclusion

GRADIA PLUS LB and HB had higher wear resistance and lower wear value of enamel antagonist due to ultra fine filler content and most suitable treatment for filler by a silane coupling agent. GRADIA™ PLUS should lead to clinical longevity.


GRADIA

NOTCHLESS TRIANGULER PRISM FRACTURE TOUGHNESS OF NEW INDIRECT COMPOSITE.

Study by H. Kato, D. Machida, T. Ueno, T. Kumagai (Research & Development Department, GC Corp., Tokyo, Japan), presented during ADM2016

1. Abstract

A new indirect composite system has been developed, GC GRADIA™ PLUS LB (Light Body, flowable type) / HB (Heavy body, paste type) (Fig.1). GRADIA™ PLUS overcomes weaknesses of Micro-Filled Resin (MFR) by adopting nano-filler technology, the same as G-ænial universal flo (composite resin, GC) and CERASMART™ (CAD/CAM resin block, GC). All demonstrate with high wear resistance and high mechanical properties. Fracture toughness of dental materials is evaluated as a method to measure a resistance level of the destruction. Notchless trianguler prism (NTP) fracture toughness test has been paid attention as an effective method for measuring fracture toughness of composite resin. The purpose of this study is to evaluate the NTP fracture toughness of GC GRADIA™ PLUS and other indirect composite resin.

2. Materials (Table 1)

Code / Material	Manufacturer	Lot No.
GPL / GC GRADIA™ PLUS LB*	GC	1506191G
GPH / GC GRADIA™ PLUS HB*	GC	1506201G
GR / GC GRADIA™	GC	1411101
SC / Signum Ceramics	Heraeus Kulzer	010205A
CLF / crea.lign flow	Bredent	N144514
CLP / crea.lign paste	Bredent	144309
NP / SR nexco paste	Ivoclar/Vivadent	T20056

Specimens of each indirect composite resin were formed for each material using metal mold and cured according to the manufacturers' instructions for use.

3. Filler of each material (Table 2)

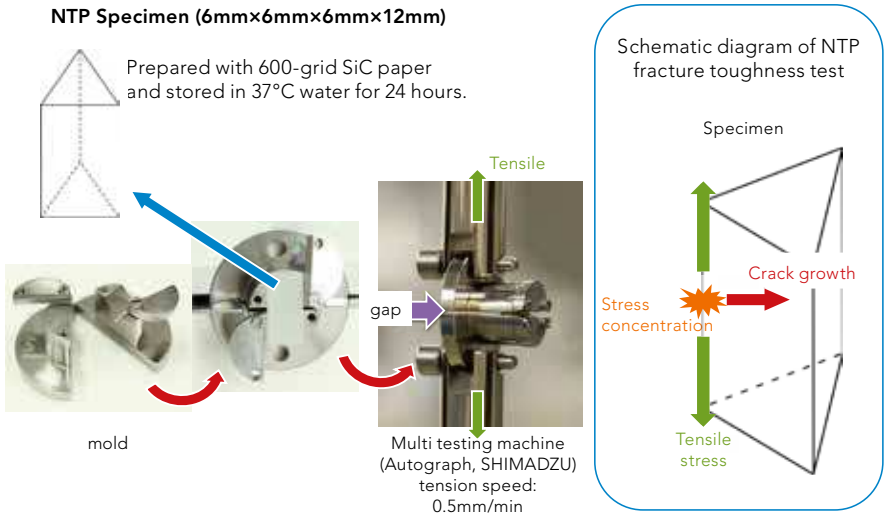
	GPL	GPH	GR	SC	CLF	CLP	NP
Glass filler size	300nm	300nm	1μm	0.6-1μm	40nm	40nm	10-50nm
Pre-polymerized filler size	none	10μm	10μm	20μm	20μm	20μm	20μm

GPL and GPH exhibited significantly higher NTP fracture toughness, flexural strength and flexural elastic modulus compared to the other indirect composite resin (Fig. 4). Products which exhibited high flexural strength and high flexural strength tended to exhibit high NTP fracture toughness (Fig. 5).

GR, SC, CLF, CLP and NP which contained pre-polymerized filler (Fig.3, Table2) exhibited lower NTP fracture toughness and flexural strength. Pre-polymerized filler is difficult to be treated by a silane coupling agent due to lower filler content, so it causes low cohesion between pre-polymerized filler and resin matrix. GPL and GPH contain polyfunctional monomer and are filled ultra fine filler at high density which is most suitably treated by a silane coupling agent. Polyfunctional monomer forms a complicated network by polymerization and abundant ultra fine filler raise strength of composite resin more. Therefore, GPL and GPH exhibited higher properties.

4. Methods

I. NTP fracture toughness



Fracture surface of each prism was inspected by scanning electron microscope (SEM, HITACHI).

NTP fracture toughness (KIC) calculations

$$KIC = \frac{Pmax \bullet Y^{*}min}{D \bullet W0.5}$$

KIC: the fracture toughness (MPa•m0.5)
Pmax: the maximum load at fracture (N)
D: the specimen diameter (12mm)
W: the specimen length (10.5mm)
Y*min: the minimum of the dimensionless stress intensity factor coefficient (= 28)

II. Flexural strength

Flexural strength and flexural elastic modulus of each material were measured in conformity to ISO 10477(N=5). Results were analyzed by two-way ANOVA ($p<0.05$).

5. Results and Discussion

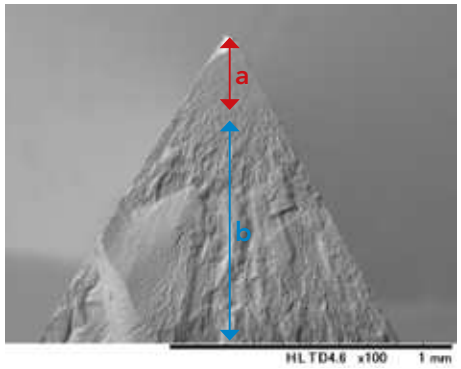


Fig.2 SEM micrographs of fracture surface
table fracture(a) and unstable fracture(b) which was feature of mode I fracture were confirmed in all specimens. Herewith, it was confirmed that NTP fracture toughness could be measured.

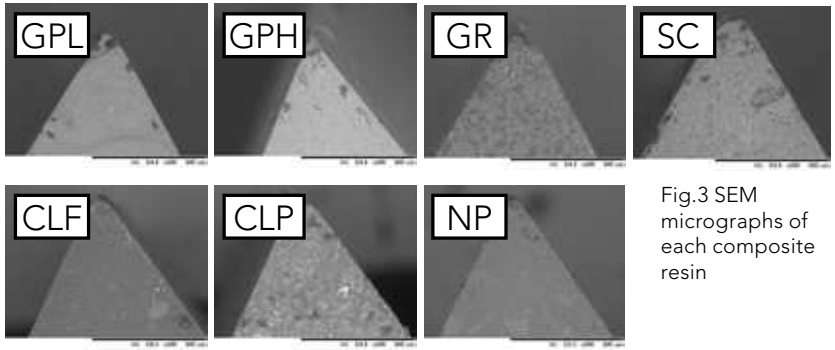


Fig.3 SEM micrographs of each composite resin

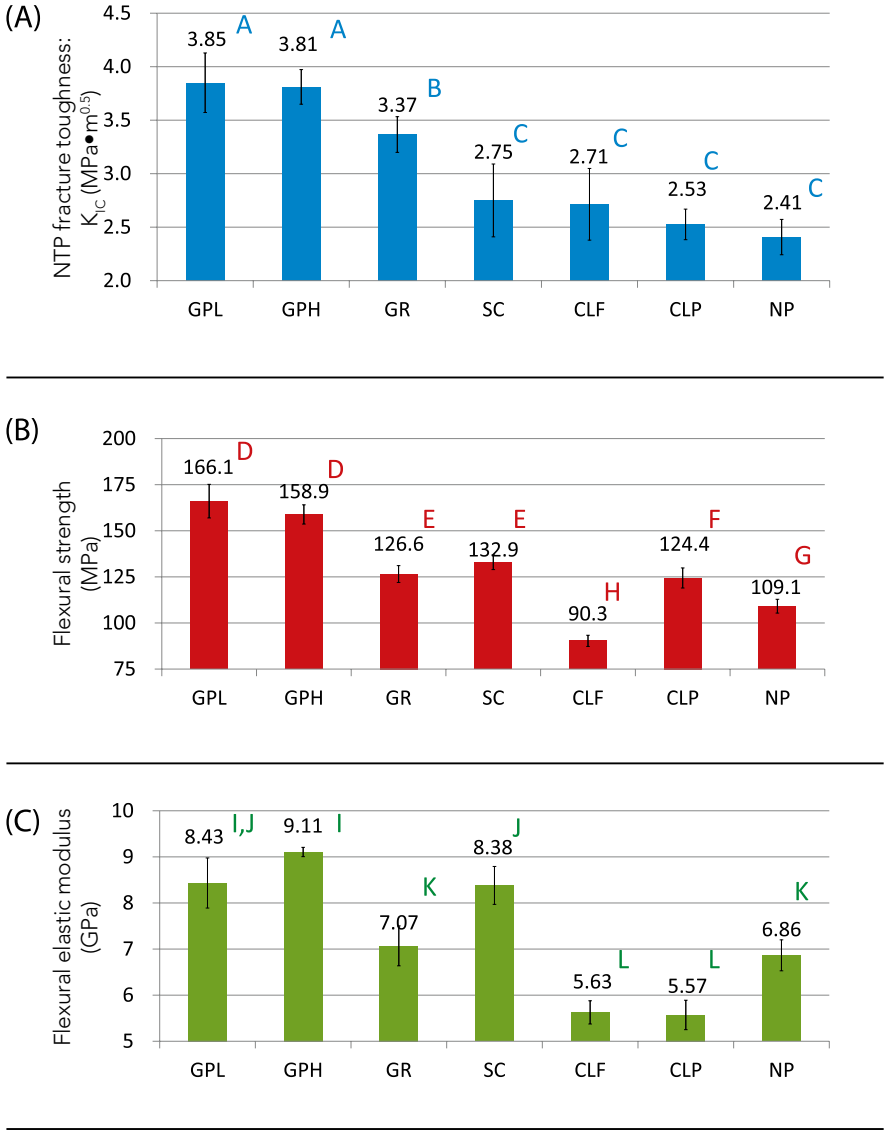


Fig. 4 NTP fracture toughness (A), flexural strength (B) and flexural elastic modulus (C) of each material.
Same superscript indicates no statistically difference.

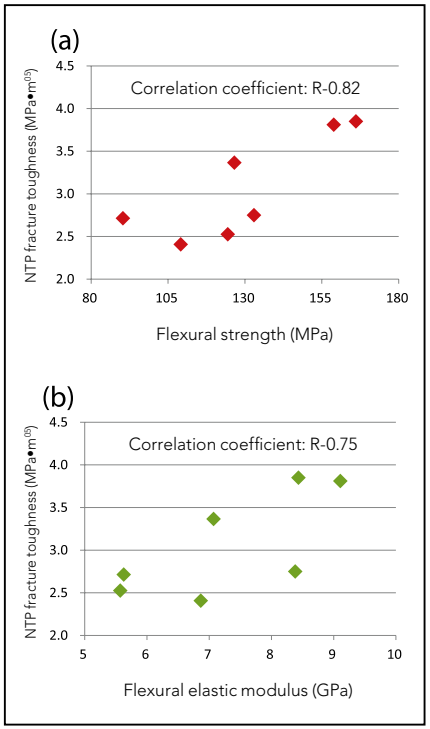


Fig. 5
Correlation between KIC and flexural strength (a), or flexural elastic modulus (b).

6. Conclusion

New indirect composite, GC GRADIA™ PLUS LB and HB, exhibited higher NTP fracture toughness than the other indirect composite resin, and it may suggest that GC GRADIA™ PLUS is not easily fractured in clinical use.


GRADIA

9. Questions and Answers

1. Will the bond strength of GC METALPRIMER Z be affected if the alloy surface is touched after sandblasting?
Yes. Sandblast the alloy surface again and reapply GC METALPRIMER Z.

2. Should sandblasted metal be ultrasonic or steam cleaned?
No. Simply use filtered air pressure to remove aluminum oxide residue.

3. Opaque is a little thick when dispensing from the syringe. Is this a problem?
No. GC GRADIA™ PLUS pastes are thixotropic (certain gels exhibit this property but they become more fluid when stirred or put into motion, e.g. by a syringe plunger). The thixotropic property helps to control the flow and prevents OPAQUE from flowing into undesired areas.

4. Can OPAQUE be diluted to improve flow?
No, it cannot be diluted. The flow can be improved by stirring it with a brush or spatula.

5. Is it possible to cover RETENTION BEADS with a single layer of OPAQUE?
This will depend on the amount and size of the used retention beads. You should apply the opaque in a fine layer and light-cure. Repeat this process until the metal color is masked out. Alternatively, use the LB CLF (clear) to cover the retention beads, light-cure and then cover as usual with the opaque.

6. The OPAQUE did not cure well.
The OPAQUE layer might be applied too thick. Remove it and apply two very thin layers instead of one thick layer. Check that your light-curing device is functioning correctly.

7. How can entrapping air bubbles be prevented?
There are two ways:
1. Before applying the resin, lightly tap the top of the paste surface with a spatula (the spatula edge should not be nicked or rough as this will also cause bubbles).
2. Use GC GRADIA™ PLUS Modeling Liquid by wetting spatula or brush in order to smoothen the surface. Use moderately. Light-cure for one minute before applying the next paste layer.

8. Which paste should be used on the hollow part of a pontic?
Build-up with CL-F, contour to conform to the adjacent area, light-cure, apply OPAQUE and light-cure again.

9. Which light-curing unit should be used?
Refer to page 29.
GC GRADIA™ PLUS can be light-cured with GC Labolight DUO (step and final cure), GC LABOLIGHT LV-III (final cure), GC STEPLIGHT SL I (step cure only).

10. How do I obtain a nice gloss on the surface?
In order to obtain a good gloss on the composite you can choose between polishing methods:
A. By using our dedicated GC GRADIA™ PLUS Lustre Paint as a surface coating agent.
   1. Roughen the resin surface using a carbide bur or sandblast (1.5 kg/cm^2) to obtain the mechanical retention. Dry and clean with an air gun.
   2. Priming: Immediately apply a silane coupling agent CERAMIC PRIMER II (GC) to the resin surface and dry.
   3. Coloring, coating and final light-curing: Apply a thin layer (<0.1mm) of Lustre Paint over the resin surface and final-cure.
      To prevent contamination, wash the brush with LP Diluting Liquid every time. Refer to page 26-27.

B. By manual polishing using our dedicated GC DIAPOLISHER PASTE
   Use proper instruments and burs to polish and finish the prosthesis, and to confirm, remove any agent or paste for polishing and finishing in the proper way and see that the surface has a proper shine.

11. The paste starts curing while I'm working with it.
Avoid working in direct sunlight (near a window) or within 30cm of a lab light. GC GRADIA™ PLUS is designed to promptly react to light for better physical properties.
Use a working plate with a cover to protect from light. Always close the syringes.

12. Are there any ccontraindications?
Avoid use of this product in patients with known allergies to methacrylate monomer, methacrylate polymer or alcohol.

13. How should GC GRADIA™ PLUS be stored?
Recommended for optimal performance, store in a cool place (4-25°C / 39.2-77.0°F). away from high temperatures or direct sunlight.

14. Can I use GC GRADIA™ PLUS to veneer zirconium dioxide frameworks?

Yes, but consider the following points in order to have a secure working procedure:

- Framework:
  The framework should be anatomic in design, supporting the composite (same thicknesses everywhere)
  Create a lingual band and eventually also a small vestibular band, small mechanical retention/stress breakers are advised
- Step by step :
  Sandblast zirconium framework and steam clean and then apply CERAMIC PRIMER II to the zirconium surface and let it dry (1min)
  To ensure a correct wettability, directly apply GC GRADIA™ PLUS Opaque, alternatively use GC GRADIA™ PLUS Light Body (colored or clear) and light-cure as usual
  Apply the next GC GRADIA™ PLUS pastes in the usual step-by-step way

15. Can I use GC GRADIA™ PLUS to veneer PEEK/PEKK frameworks?

Yes. Please follow the recommendations of the respective PEEK/PEKK and consider following points concerning the framework in order to have a secure working procedure.
The framework should be anatomic in design, supporting the composite (same thicknesses everywhere).
Create a lingual band and eventually also a small vestibular band, small mechanical retention/stress breakers are advised.
Based upon internal testing, the following recommendations for the building up procedure of peek are:

1. Sandblast the PEEK/PEKK framework (0.2MPa, 50 micro-meter, Al_2O_3) .
2. Clean and dry with air gun.
3. Apply GC GRADIA™ PLUS Opaque and light-cure.
4. Proceed by following the usual step by step procedures of GC GRADIA™ PLUS.

10. Related Products

GC LABOLIGHT DUO

LED dual-mode light-curing unit for indirect composite techniques

The days when you needed two curing devices in your laboratory (one for intermediate and another for final curing) are now a thing of the past. GC is now offering a state of the art multi-functional light-curing device for the technician combining 2 curing modes: pre-curing (step mode) and final curing (full mode).

Latest LED technology inside

Equipped with double wave length LED technology the Labolight DUO can be used to cure any of GC's composites in a secure and durable way. It offers a wavelength range of 380nm – 510nm with spectrum ranges peaks of:

- 465 nm-485 nm (12 Blue LED's)
- 390 nm-400 nm (3 Violet LED's)

This technology ensures optimal hardening of all light-cured dental materials, while the high power outlet reduces light-curing cycles.

Automated rotary system

The reflective plate distributes all light effectively and exposes your works from all sides. The curing stand carefully positions the objects during all light-curing cycles.

Compact & ergonomic design

The GC Labolight DUO is not only capable of handling most of your work, it looks good as well. The award winning sleek, contemporary styling with smooth surfaces allows for easy cleaning and reduces the space it takes in your lab.

This design serves the usability: the interface is very simple and intuitive and the inner parts are easily accessible thanks to the wide opening.

Step mode

Full mode

CERASMART™270

Force Absorbing Hybrid Ceramic CAD/CAM Block

Advantages

CERASMART™270 is developed using the FSC technology, an innovative filler treatment method for homogeneous filler dispersion, having a great impact on physical properties. A stronger bond between the filler and matrix is achieved, together with an increase in filler load, resulting in a stronger material with improved aesthetic properties.

Strong and flexible
- Very high flexural strength to ensure longevity
- High flexibility with high breaking energy to buffer masticatory pressure
- Ultra-fine fillers coated for a long-lasting gloss and extremely low wear to the opposing dentition

Flexible and precise
- Fast and precise milling, superb marginal adaptation
- High radiopacity for an easy follow-up

Precise and beautiful
- Warm colours for very natural fluorescence and opalescence
- Very smooth surface right after milling
- Easy to achieve superior gloss that lasts

Beautiful and convenient
- CERASMART270 is the only hybrid ceramic block that can be either sandblasted or pre-treated with hydrofluoric acid
- CERASMART270 can be either polished or characterised with OPTIGLAZE color, a wear resistant coating solution that is unique to GC.
- For more enhanced aesthetics GC GRADIA Plus pastes can be used

Characterization is very easy using the wear resistant coloring glaze GC GRADIA™ PLUS Lustre Paint or OPTIGLAZE color: pre-treat, apply and light-cure to adapt the shade as much as you wish. For more enhanced aesthetics and shape adjustments, GC GRADIA™ PLUS pastes can be used.

GC Stick

Fibre reinforcements for composites and acrylics

GC Stick provides a strong, aesthetic and profitable solution for strengthening composites and acrylics. It is made of silanated E-glass fibres embedded in a polymer matrix. This reinforcement can be used with light-cured, chemically-cured and dual-cured resins and composites, as well as with powder-liquid acrylics. The unidirectional Stick fibre bundle adds strength and stiffness to the material in the direction of the fibres.

Indications

- Surface-retained bridges
- Inlays and onlay bridges
- Implant-supported bridges
- Hybrid bridges
- Temporary bridges
- New partial and fully removable dentures
- Denture repairs

Advantages

- Solution for a wide range of indications
- Compatible with most composites and acrylics
- Unique patented bonding
- Low starting investments
- Simple and time-saving fabrication method
- As strong as metal
- Metal-free and aesthetic
- Easy to repair
- Extensive research data

GC REPAIR KIT

Using the GC Repair Kit and a conventional operatory curing light makes intra-oral repairs quick and easy.

GC INITIAL™ CAST NP

Dental casting alloy for crown and bridge work

For framework-based restorations, the foundation for a durable, aesthetic dental restoration is a high-performance dental alloy. With Initial™ CAST NP, GC offers a cobalt chrome-based casting alloy that sets new benchmarks for versatility, performance, handling and aesthetics. GC Initial™ CAST NP has been designed for ceramic (GC Initial™) and composite (GC GRADIA™ PLUS) veneering techniques. This one alloy covers a wide variety of applications - everything from a crown to a long-span bridge.

EXACLEAR

Clear vinyl polysiloxane material

EXACLEAR is an innovative, clear silicone material made to fulfil the demands for high aesthetics while facilitating the way to great results. Thanks to its transparency, ease of handling and rigidity after setting, EXACLEAR makes complex procedures much easier and provides a smoother workflow.

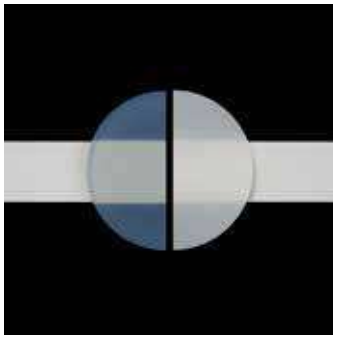
EXACLEAR is very useful to create temporary crowns and veneers. Using the GC GRADIA PLUS Light Body rather than acrylics is easier and less technique sensitive. Simply inject the material into the EXACLEAR mould!

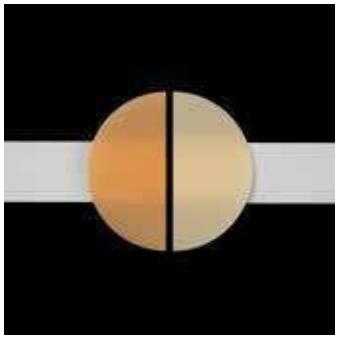
Advantages:

- Crystal clear view
  - optimal visual control due to the high transparency
  - excellent control of details
- Easy handling
  - optimal consistency for a successful procedure
  - firm but flexible material
- Easy removal and repositioning of the material without tearing
- Fast setting
  - when working on a model, material sets within 7 minutes

GC INITIAL™ SYNERGIES COLOR APPROACH

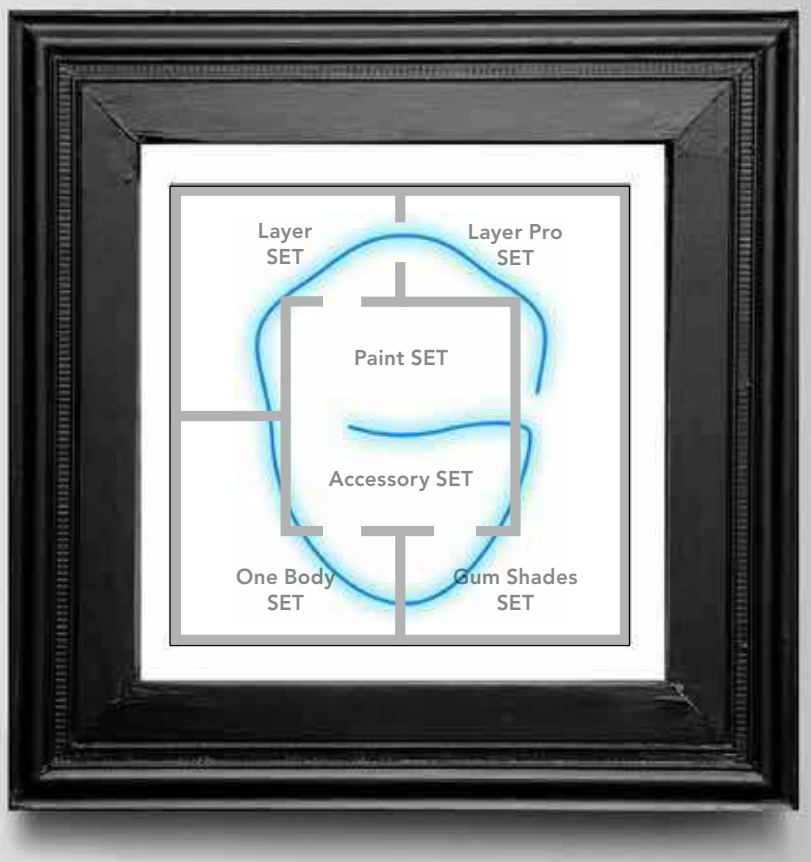
COLOR CORRESPONDENCE TABLE GC Initial™ - GC GRADIA™ and GC GRADIA™ PLUS MDT T. Okawa / MDT C.Thie		
GC Initial™	**GC GRADIA™ PLUS**	
EI-12	LB Base E + LB Yellow	3:1
EI-13	LB Base E + LB Yellow	2:1
EI-14	LB Base E + LB yellow	1:1
EO-15	LB B	
EO-16	LB D	
EOP 2	LB Base Opal + LB Base E	1:2
EOP 3	LB Base Opal + LB Base Enamel	1:1
EOP 4	LB Base E+LB Base Opal 1:1 (+ LB grey 3:1)	
TO	LB Base E	
TN	LB Base T	
CL-F	HB-CLF/LB Base CLF	
TM-01	LB Base CLF + LB Blue	5:1
TM-02	LB Base CLF + LB W	5:1
TM-03	LB Base CLF + LB Red	5:1
TM-04	LB Base CLF + LB Orange	5:1
TM-05	LB Base CLF +LB Grey	5:1
CT-22	LB Inlay TD	
CT-23	LB Red + LB Yellow	2:1
FD 91	LB Base D + LB DW	1:2
FD 92	LB Base D + LB Yellow	1:2
FD 93	LB Base D + LB Red	1:2
IN-42	LB Base OD + LB Orange	1:1
IN-43	LB Base OD + LB Yellow	1:1
IN-44	LB Base OD	
IN-45	LB Base OD + LP B (coloring)	
IN-51	LB Base OD + LP D (coloring)	
	GLB-CL +GLB-2	2:1
GM 23	GLB 2	
GM 24	GLB 1 + GLB 3	2:1
GM 34	GLB 3 + LP Violet (coloring)	
GM 35	GLB 3 + LP A (coloring)	
GM 36	GLB-1	
GU	GLB 1 + GLB 2	2:1
	GO 1	
	GO 2	
	GO 1 + GO 2	1:1





When you just want something simple and uncomplicated

The colour range of this remarkable composite has been carefully chosen, fine-tuned and adapted to the needs of today's dentistry. With fewer standard colours but more individual mixing and layering options, GC GRADIA™ PLUS is more compact and cost-effective.



The unique modular concept allows you to step into the system wherever you like. There is always a set or a combination that will meet your demands regarding indications or technique, from classic or multi-chromatic build-up to a monolithic approach, with or without gingival colours.

GRADIA™ PLUS from GC – where rational means modular

11. Item list

SET CONTENTS AND INDIVIDUAL ITEMS

GC GRADIA™ PLUS Layer Set

901048	**Content:** 5x GC GRADIA™ PLUS Opaque 2.0mL O-Base, OA, OB, OC, OD 14x GC GRADIA™ PLUS Paste Heavy Body 3.3 mL HB-DA1, HB-DA2, HB-DA3, HB-DA3.5, HB-DB1, HB-DB3, HB-DC3, HB-DD2, HB-EL, HB-ED, HB-CLF, HB-PE, HB-ODA, HB-ODB 5x GC GRADIA™ PLUS Dispensing Tip Needle Tip & Light Protective Cover 1x Mixing Pad No. 22 1x Plastic Spatula No. 2 Blue

GC GRADIA™ PLUS Layer Pro Set

901409	**Content:** 4x GC GRADIA™ PLUS Paste Heavy Body 3.3mL HB-ODC, HB-ODD, HB-ODW, HB-DW 16x GC GRADIA™ PLUS Paste Light Body 2.0mL LB-Base E, LB-Base CLF, LB-Base D, LB-DW, LB-Base OD, LB-ODW, LB-Base Opal, LB-Orange, LB-Yellow, LB-Red, LB-Grey, LB-Blue, LB-Milky, LB-Inlay E, LB-Inlay TD 10x GC GRADIA™ PLUS Mixotip 15x GC GRADIA™ PLUS Dispensing Tip Plastic Type Wide & Light Protective Cover 1x Mixing Pad No. 22 1x Plastic Spatula No. 2 Blue

GC GRADIA™ PLUS Paint Set

901050	**Content:** 10x GC GRADIA™ PLUS Lustre Paint 0.8mL LP-A, LP-B, LP-C, LP-D, LP-CLF, LP-CL, LP-Blue, LP-Grey, LP-Cream, LP-Lavender 1x GC GRADIA™ PLUS Lustre Paint Diluting Liquid 3mL 10x GC GRADIA™ PLUS Dispensing Tip Needle Type Small & Light Protective Cover 10x Brush Round, N° 1 10x Brush Flat, N° 1 2x Brush Holder (Ivory & White) 5x Disposable Palette 1x Mixing Pad No. 14B

GC GRADIA™ PLUS Gum Shades Set

901051

Content:

1x GC GRADIA™ PLUS Opaque 2.0mL O-Base

2x GC GRADIA™ PLUS Gum Shades Opaque 2.0mL GO-1, GO-2

1x GC GRADIA™ PLUS Lustre Paint 0.8mL LP-CL

2x GC GRADIA™ PLUS Gum Shades Lustre Paint 0.8mL

GLP-Bright Red, GLP-Violet

4x GC GRADIA™ PLUS Gum Shades Light Body 2.0mL

GLB-1, GLB-2, GLB-3, GLB-4

1x GC GRADIA™ PLUS Gum Shades Heavy Body 3.3mL

GHB-2

1x GC GRADIA™ PLUS Lustre Paint Diluting Liquid 3mL

10x GC GRADIA™ PLUS Mixotip

5x GC GRADIA™ PLUS Dispensing Tip Plastic Type Wide & Light Protective Cover

5x GC GRADIA™ PLUS Dispensing Tip Needle Type Small & Light Protective Cover

5x GC GRADIA™ PLUS Dispensing Tip Needle Tip & Light Protective Cover

10x Brush Round, N° 1

10x Brush Flat, N° 1

2x Brush Holder (Ivory & White)

5x Disposable Palette

1x Mixing Pad No. 14B

1x Plastic Spatula No. 2 Blue

GC GRADIA™ PLUS One Body Set

901052

Content:

5x GC GRADIA™ PLUS Opaque 2.0mL

O-Base, OA, OB, OC, OD

1x GC GRADIA™ PLUS Paste Light Body 2.0mL

LB-Base OD

5x GC GRADIA™ PLUS One Body 2.0mL

LB-A, LB-B, LB-C, LB-D, LB-W

10x GC GRADIA™ PLUS Dispensing Tip Plastic Type Wide & Light Protective Cover

5x GC GRADIA™ PLUS Dispensing Tip Needle Tip & Light Protective Cover

1x Mixing Pad No. 22

1x Plastic Spatula No. 2 Blue

GC GRADIA™ PLUS Accessory Set

901053

Content:

1x GC GRADIA™ PLUS AIR BARRIER 10mL

1x GC GRADIA™ PLUS SEPARATOR 5mL

1x GC GRADIA™ PLUS DIE HARDNER 5mL

1x GC GRADIA™ PLUS Modeling Liquid 3mL

1x CERAMIC PRIMER II 3mL

1x Metalprimer Z 5mL

1x Acrylic Primer 5mL

1x Diapolisher Paste 2g

10x Brush Round, N° 1

10x Brush Flat, N° 1

2x Brush Holder (Ivory & White)

1x Brush N° 7

1x Shade Guide Kit

1x Mixing Pad No. 22

GC GRADIA™ PLUS Liquids

901138	GC ACRYLIC PRIMER, 6mL, 1pce	
901128	GC GRADIA™ PLUS AIR BARRIER, 10mL, 1pce	
901129	GC GRADIA™ PLUS Modeling Liquid, 3mL, 1pce	
901127	GC GRADIA™ PLUS LP Diluting Liquid, 3mL, 1pce	
901130	GC GRADIA™ PLUS SEPARATOR, 5mL, 1pce	
901131	GC GRADIA™ PLUS DIE-HARDENER, 5mL, 1pce	

GC GRADIA™ PLUS Refills

GC GRADIA™ PLUS Opaque syringe - 2.0mL
O-Base, OA, OB, OC, OD, GO-1, GO-2

GC GRADIA™ PLUS Paste Heavy Body syringe - 3.3mL
HB-DA1, HB-DA2, HB-DA3, HB-DA3.5, HB-DB1, HB-DB3, HB-DC3, HB-DD2,
HB-DW, HB-EL, HB-ED, HB-PE, HB-CLF, HB-ODA, HB-ODB, HB-ODC HB-ODD, HB-ODW,
GHB-1, GHB-2, GHB-3, GHB-4

GC GRADIA™ PLUS Paste Light Body syringe - 2.0mL
LB-Base E, LB-Base CLF, LB-Base D, LB-Base OD, LB-Base Opal, LB-Orange, LB-Red, LB-Yellow,
LB-Blue, LB-Grey, LB-Milky, LB-Inlay E, LB-Inlay TD,
LB-DW, LB-ODW, GLB-1, GLB-2, GLB-3, GLB-4

GC GRADIA™ PLUS Lustre Paint syringe - 0.8mL
LP-A, LP-B, LP-C, LP-D, LP-Cream, LP-Grey, LP-Lavender, LP-Blue, LP-CLF (Glass Clear),
GLP-Violet, GLP-Bright Red, LP-CL (Glass Clear)

GC GRADIA™ PLUS ONE BODY syringe - 2.2mL
LB-A, LB-B, LB-C, LB-D, LB-W

Notes

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