Glass Hybrids: Cost-effective,
long-term restorative alternative

EQUIA Forte™ HT

from GC

COMPREHENSIVE GUIDE

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Table of Contents

1. Introduction to Glass Hybrids

With growing global voices from politicians and environmental activists against the use of mercury in dentistry, the need to develop an alternative to amalgam has been one of the most challanging tasks for the dental industry in recent times. **Cost-effectiveness, quick and easy to use, low technique-sensitivity, long-term clinical evidence and tooth-friendly** are the desirable features expected from a routine restorative (like amalgam). However, it is also recognised that it might be difficult to have all these features available in a single material.

In 2014, GC introduced a new class of cost-effective, long-term restorative alternative material, called glass hybrids (GH). The GH technology offers a **unique combination of different kinds or sizes of filler particles** that are uniquely dispersed in the matrix.

The current products featuring the **advanced GH technology - EQUIA Forte and EQUIA Forte HT** - are made of fluor-aluminosilicate glasses reinforced with a second, smaller and more reactive silicate particle type. The unique polyacrylic acid powder with higher molecular weight further improves mechanical properties and handling.

This advanced technology in GH results in **increased mechanical strength** by improving **filler loading** and also offer an **improved handling** and **optimized setting reaction** that clinically **helps to reduce the technique-sensitivity**.
The first generation of the EQUIA family was introduced in 2007 and since then, there have been placed more than half a billion restorations and numerous clinical studies have been conducted.

The feedback collected in the past 15 years from key stakeholders like general practitioners and clinical and academic experts clearly indicates that the EQUIA family is able to cover almost all the desired features expected from a routine restorative.

With this comprehensive guide, we have the pleasure to share the insights of glass hybrid technology and EQUIA family.

1. Friedl K, Hiller KA, Friedl KH. Clinical performance of a new glass-ionomer based restoration system: a retrospective cohort study. Dent Mater 2011;27:1031-1037.
2. Gurgan S, Kutuk ZB, Ergin E, Oztas SS, Cakir FY. Four-year randomized clinical trial to evaluate the clinical performance of a glass ionomer restorative system. Oper Dent 2015;40:134-143.
3. Gurgan S, Kutuk ZB, Ergin E, Ozlas SS, Cakir FY. Clinical performance of a glass ionomer restorative system: a 6-year evaluation. Clin Oral Investig 2017;21:2335-2343.
4. Kielbassa AM, Glockner G, Wolgin M, Glockner K. Systematic review on highly viscous glass-ionomer cement/resin coating restorations (Part II): Do they merge Minamata Convention and minimum intervention dentistry? Quintessence Int 2017;48:9-18.
5. Opdam NJ, Bronkhorst EM, Loomans BA, Huysmans MC. 12-year survival of composite vs. amalgam restorations. J Dent Res 2010;89:1063-1067.
6. Turkun LS, Kanik O. A prospective six-year clinical study evaluating reinforced glass ionomer cements with resin coating on posterior teeth: Quo vadis? Oper Dent 2016; 41:587-598.

2. Product description

EQUIA Forte HT is a glass hybrid restorative system that combines a self-cure bulk fill restorative (EQUIA Forte HT Fil) with a highly filled, light-cure resin coating agent (EQUIA Forte Coat) (Fig. 1).

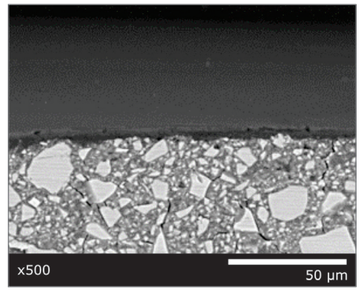


Figure 1: Scanning electron microscopy of EQUIA Forte HT, comprising of EQUIA Forte HT Fil covered with EQUIA Forte Coat.
Source: GC R&D, Japan, 2020

The advanced GH technology used in EQUIA Forte and EQUIA Forte HT is made of fluor-aluminosilicate glasses reinforced with a second, smaller and more reactive silicate particle.

The unique polyacrylic acid powder with higher molecular weight further improves mechanical properties and handling.

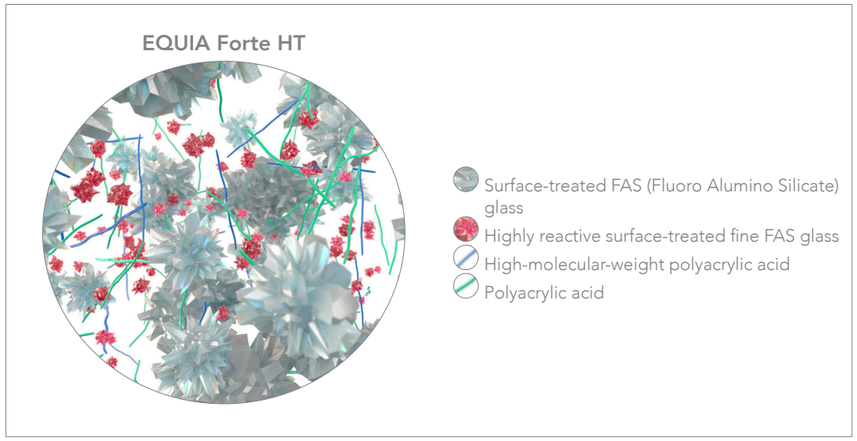


Figure 2: Difference between EQUIA Forte/EQUIA Forte HT and EQUIA.

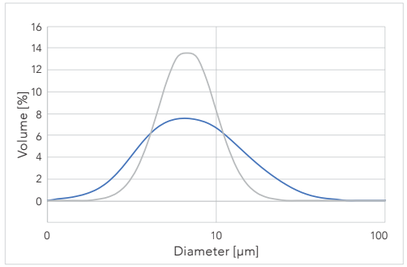


Figure 3: Distribution of filler size in EQUIA Forte (grey) and EQUIA Forte HT (blue).
Source: GC Corporation R&D, Japan. Data on file.

The particle size distribution in EQUIA Forte HT has been further optimised compared to its predecessor (EQUIA Forte) (Fig. 3). As a consequence:

- the **flexural strength** and **compressive strength** have been increased even further due to improved matrix loading.

- the extruding time has increased, while the setting time has remained; therefore, the **handling has improved** as the practitioner has more time to place and sculpt the restoration, without increasing the total placement time.

Another difference between EQUIA Forte HT and EQUIA Forte lies in its translucency; due to new developments in glass hybrid technology, the refractive index of the glass could be decreased to obtain a better match with the matrix. As a result, the translucency has increased, which has resulted in an aesthetic improvement.

EQUIA Forte Coat is a unique self-adhesive surface treatment material which protects and optimises the physical properties of the underneath EQUIA Forte HT Fil restoration.

The coat is highly filled with 40 nm silica fillers and a **filler dispersion technology** (Fig. 4) that ensures the uniform repartition of the fillers in the material is used. Thanks to this filler dispersion, a high wear resistance can be expected.

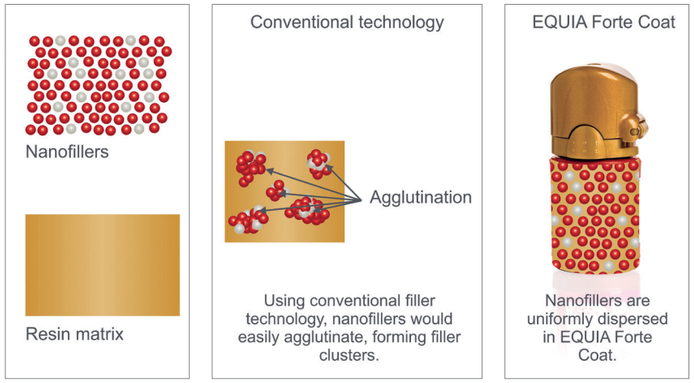


Figure 4: Uniform dispersion of nanofillers in EQUIA Forte Coat

It also contains a new, highly reactive multifunctional monomer. This innovation is responsible for an increase of around 35% in surface hardness and more than 40% in wear resistance as compared to its predecessor, i.e. EQUIA Coat (Fig. 5).

The film thickness of EQUIA Forte Coat is as low as 35 to 40 µm and the resin is able to penetrate the surface of the EQUIA Forte HT restoration, filling pores and micro fissures and rendering the final restoration much stronger (Fig. 6). Even more important, the coating is able to protect EQUIA Forte HT during its initial setting period, when it is mostly susceptible to water uptake or dehydration.

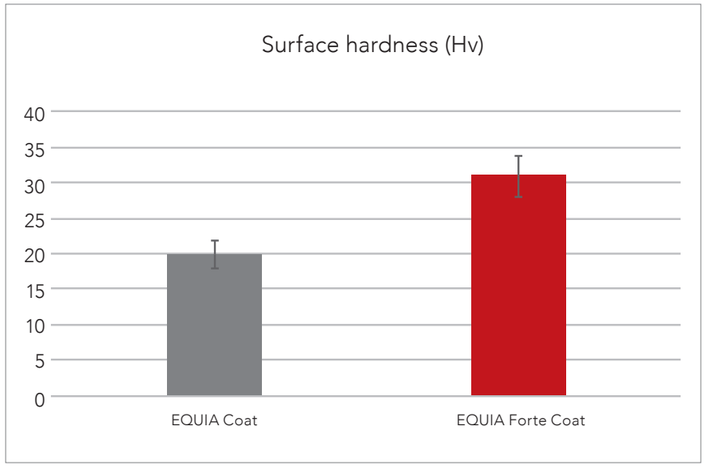


Figure 5: Vicker's hardness of EQUIA Forte Coat in comparison to EQUIA Coat.
Source: GC Corporation R&D, Japan. Data on file.

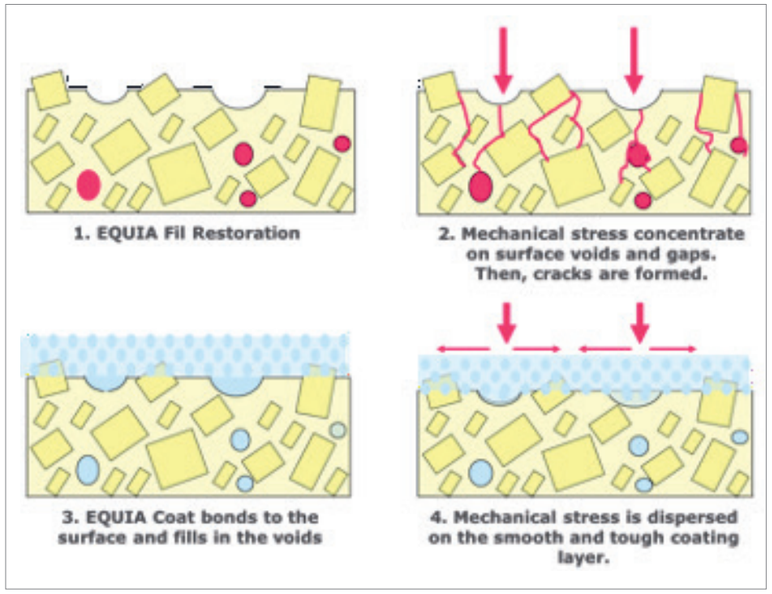


Figure 6: Synergy between EQUIA Forte HT Fil and EQUIA Forte Coat

The formulation of EQUIA Forte Coat has been designed to allow evaporation of some specific components (monomers) during light-curing, thereby limiting the contact of the coating with oxygen from the air (Fig. 7). As a result, no air inhibition layer is formed and the surface is kept smooth and glossy.

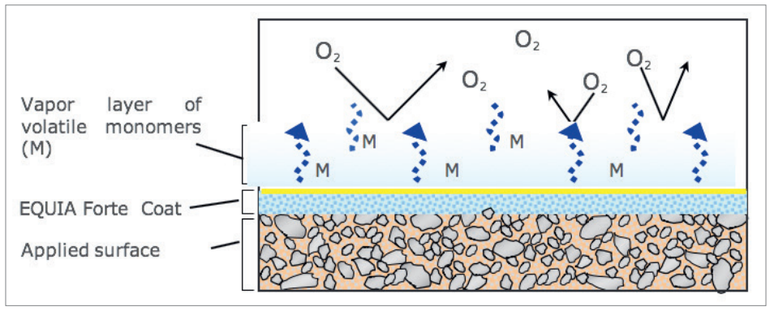


Figure 7: Vapor layer preventing the inhibition of polymerisation by oxygen

What happens when the Coating wears off?

The nano-filled resin coat is designed to ensure that it wears off in time. The estimated time for abrasion is around 300 to 500 days. The abrasion is uniform and once the coating has worn off, the setting of the glass hybrid is completed and will undergo its second maturation period which happens in contact with saliva (Fig. 8). In this period, it will uptake more ions such as calcium from the saliva. After this maturation period, an even stronger restoration can be expected.

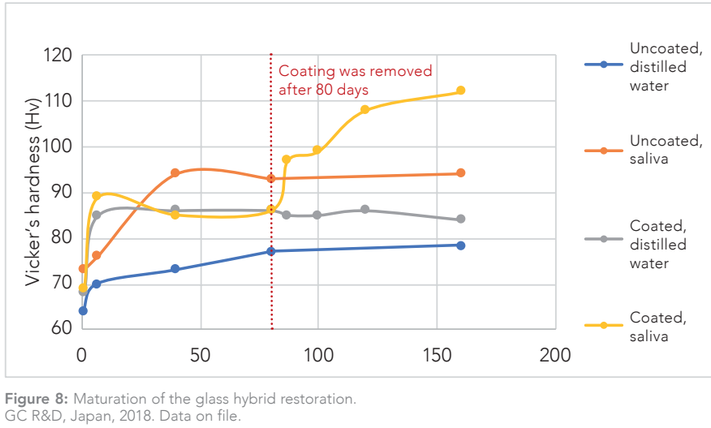


Figure 8: Maturation of the glass hybrid restoration.
GC R&D, Japan, 2018. Data on file.

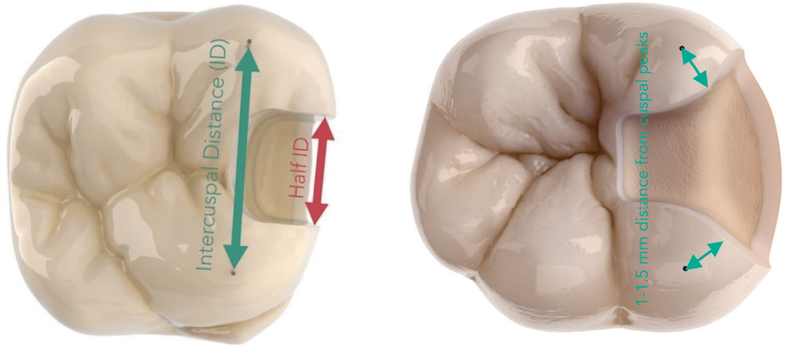
Indications for use

The EQUIA Forte HT restorative system is recommended for the following uses:

1. Class I restorations
2. Non-bearing and load-bearing Class II restorations, keeping 1-1.5 mm distance from the cusp peaks (Fig. 9);
3. Intermediate restorations
4. Class V and root surface restorations
5. Core build-up

Specific Conditions:

6. Amalgam alternative and /or replacement
7. Restorations of hypomineralised teeth (MIH)
8. Restorations for geriatric patients
9. Restorations for pediatric patients
10. Restoration of posterior teeth in a high-caries risk patient



Recommended Class II cavity size as per the existing IFU of **EQUIA** less than half of the intercuspal distance

Recommended Class II cavity size as per the IFU of **EQUIA Forte HT**
The cavity should be prepared with up to 1-1.5 mm distance from cuspal peaks.

Figure 9: Clinical implication of the glass hybrid technology in the clinical indication of EQUIA Forte

3 Features and benefits

- The **moisture tolerance** of EQUIA Forte HT Fil enables quick and efficient placement of restorations, while use of a rubber dam is optional. Glass hybrids are hydrophilic and thus better withstand the humidity of the oral environment or the pulpal fluid flow;
- Chemically bonds to dentin, enamel and cementum to create a strong, stable and **chemically-fused seal** for long-term resistance to microleakage;
- **Helps stimulate remineralisation**, ultimately boosting the hardening process;
- Furthermore, its **pulp-friendliness** makes them particularly suitable for use in deep cavities;
- The **coefficient of thermal expansion close to tooth structure** and the **low shrinkage** behaviour is one of the main reasons for the good marginal adaptation of glass hybrids;
- Virtually **no post-operative tooth sensitivity**;
- **Packable** and **non-sticky** for fast and easy bulk placement;
- **Improved translucency** for a more natural appearance;

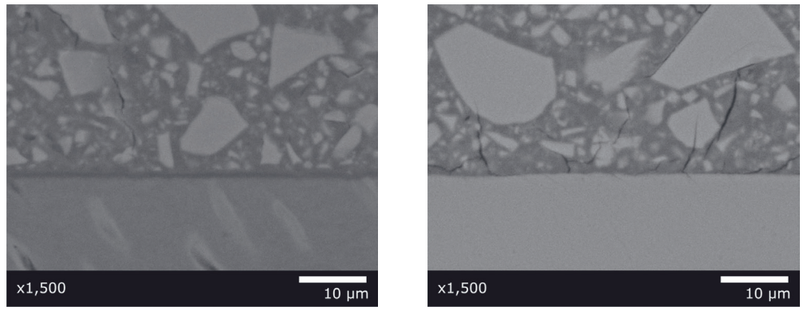


Figure 11: Scanning electron microscopy of EQUIA Forte HT adhered to dentine (left) and enamel (right).
Source: GC R&D, Japan, 2020.

4 Scientific research on EQUIA Forte HT

4.1 Physical properties

4.1.1 Compressive strength

Compressive strength is particularly important to resist masticatory loading. Twenty four hours after mixing, a compressive load along the long axis of the specimens was measured in accordance with the ISO standard (Fig. 12).

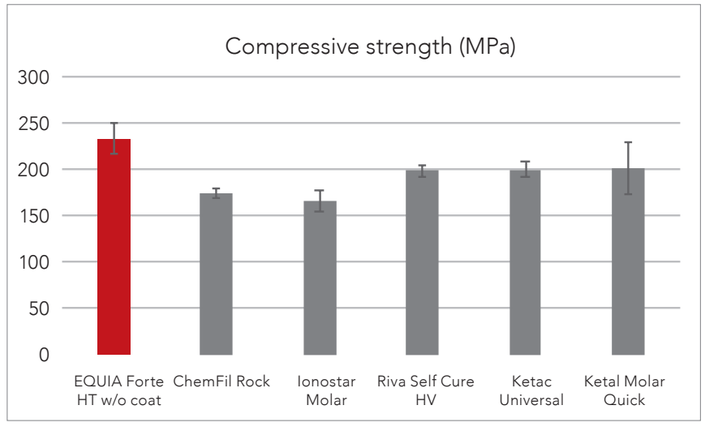


Figure 12: Compressive strength of EQUIA Forte HT Fil (uncoated) in comparison with glass ionomer restoratives. ISO9917-1: 2007. Source: GC R&D, Japan, 2018. Data on file.

The compressive strength of EQUIA Forte HT Fil significantly higher than the tested glass ionomers, even without coating. It is an excellent restorative for posterior restorations.

4.1.2 Flexural strength

Flexural strength indicates the resistance of a material against deformation and is one of the key values linked to the durability of a material (Fig. 13).

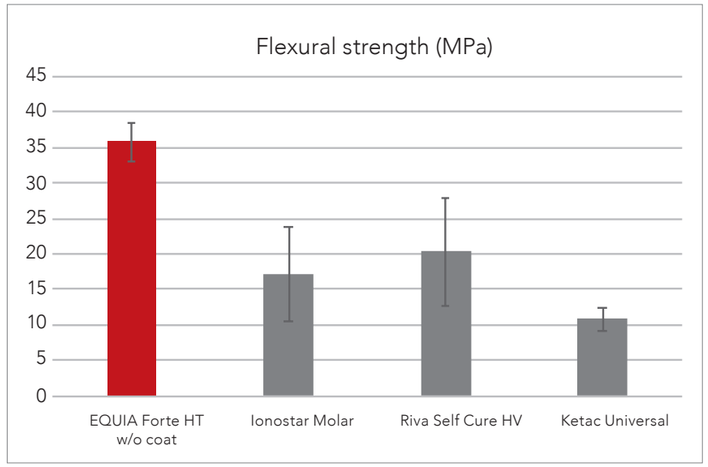


Figure 13: Flexural strength of EQUIA Forte HT Fil (coated) in comparison with glass ionomer restoratives. ISO10477-1: 2004. Source: University of Siena, Italy. Publication in preparation.

With coating, the flexural strength of EQUIA Forte HT Fil is significantly higher than the tested glass ionomers.

4.1.3 Wear resistance

The wear resistance was tested in a two-body wear test (20000 cycles; load 0.85 MPa) against bovine enamel as the opponent and with a slurry of PMMA powder and glycerin. Speciments were polished with #1000 SiC paper and immersed into water (24h, 37°C). For the coated specimens, the coat was applied after polishing. The wear was then measured as the dimensional loss after 20000 cycles (Fig. 14).

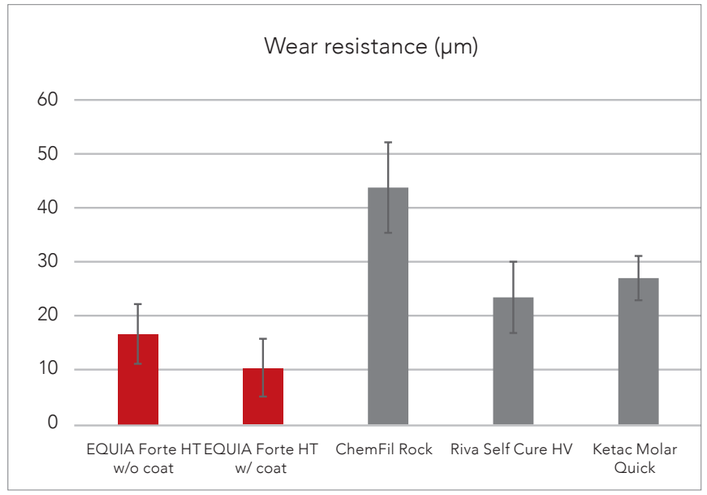


Figure 14: Wear resistance after 20000 cycles of EQUIA Forte HT Fil with and without coat in comparison with glass ionomer restoratives. Source: GC R&D, Japan, 2018. Data on file.

The lower the wear, the better the wear resistance. EQUIA Forte HT Fil wears less than the tested glass ionomers, even without coating. However, with the coat, it improved even further.

4.1.4 Microhardness

Microhardness was evaluated with the Vickers method (Fig. 15). Surfaces with lower hardness are more prone to the occurrence of surface defects, e.g. scratching during mastication.

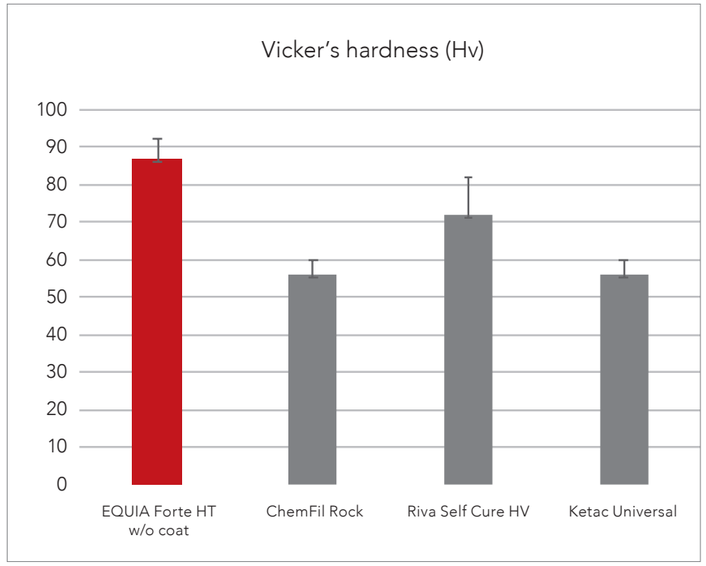


Figure 15: Vicker's hardness (Hv) of EQUIA Forte HT over time in comparison with glass ionomer restoratives.
Source: GC R&D, Japan, 2018. Data on file.

EQUIA Forte HT showed higher hardness in comparison to conventional glass ionomers.

4.2 Translucency

To test the translucency (Fig. 16), the restoratives were filled into a metal ring mold (15 mm in diameter, 0.5 mm in thickness), and stored in a closed chamber (1h, 37°C, RH 95%). The total translucency was measured using a Hazemeter (Fig. 17).

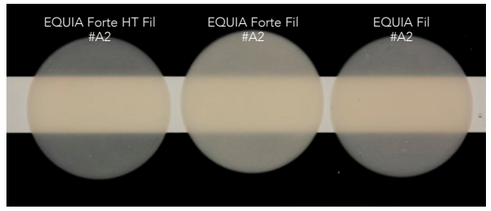


Figure 16: From left to right: EQUIA Forte HT Fil, EQUIA Forte Fil, EQUIA Fil

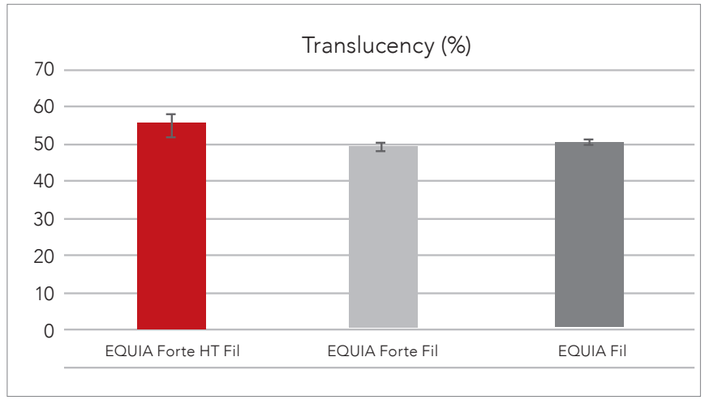


Figure 17: EQUIA Forte HT Fil was more translucent than its predecessors.
Source: Shimada *et al.* J Dent Res 2019 Vol 98 Spec Iss A: abstract #3662.

4.3 Radiopacity

The radiopacity of EQUIA Forte HT enables radiographic evaluation (Fig. 18).

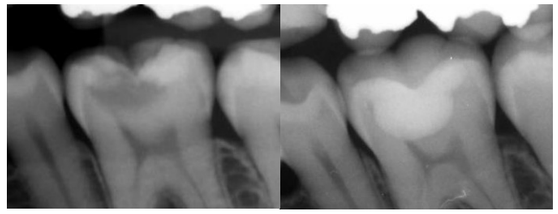


Figure 18: Left: radiograph before treatment of a molar with carious lesion; Right: radiograph after treatment with EQUIA Forte HT
Source: Ass. Prof. Z. Bilge Kütük, Turkey

The radiopacity of a dental material should be sufficient to provide proper contrast with the surrounding tooth structures and to enable the assessment of marginal overhangs, marginal gaps, proper contour as well as recurrent caries. Moderately radiopaque materials are preferable to those with a high degree of radiopacity, since the latter may obscure caries adjacent to restorations (Fig. 19).

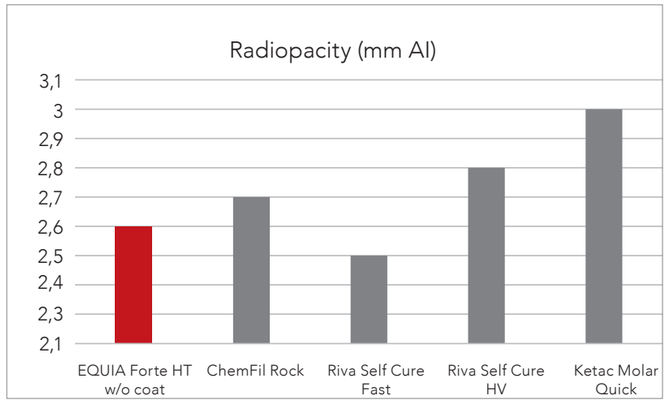


Figure 19: Radiopacity of EQUIA Forte HT is optimised for correct evaluations on radiographic images.
Source: GC R&D, Japan, 2018. Data on file.

5 Evidence-based technology and clinical performance

Over time, the glass hybrid concept has attracted considerable scientific interest, and a wide range of studies have been published on the entire EQUIA family. The most important publications have been listed here to provide you a comprehensible overview of the evidence gathered by experts all over the world.

5.1 Strong, durable, quick: the obvious restorative alternative

With the global phase-down of amalgam, it's more than needed to find suitable alternatives. Ideally, an amalgam alternative should be quick and easy to place, as well as being strong and resistant so that they can serve as a long-term option.
While resin-based materials are technique-sensitive and glass ionomers sometimes lack in physical properties, glass hybrids are:

- true bulk-fill materials
- moisture tolerant
- suitable as a long-term restoration (non-temporary)

A number of reports on clinical evaluations have been published on EQUIA as well as on EQUIA Forte.

5.1.1 Clinical studies: Class I and II

Clinical Evaluation of Microhybrid Composite and Glass Ionomer Restorative Material in Permanent Teeth.
Kharma K, Zogheib T, Bhandi S, Mehanna C.
J Contemp Dent Pract. 2018 Feb 1;19(2):226-232.

Karma et al. assessed 40 teeth with Class I cavities; half of them were filled with the EQUIA system and the other half with a microhybrid resin composite (Amelogen Plus, Ultradent). After a period of 9 months, no statistically significant differences were found between both groups in USPHS criteria. The results showed that EQUIA is a viable alternative to resin composite to restore Class I cavities.

Clinical performance of a new glass ionomer based restoration system: a retrospective cohort study.
Friedl K, Hiller KA, Friedl KH.
Dent Mater. 2011 Oct;27(10):1031-7.

Friedl et al. reported two year results for EQUIA restorations in Class I and small Class II cavities. 151 Class I (n = 26) and Class II (n = 125) restorations were placed in 43 patients in 6 dental practices. No failures were observed in this time period as all USPHS scores remained within the acceptable range. The authors concluded that EQUIA can be used as a permanent restoration material for any sized Class I and in smaller Class II cavities.

Three-year Survival Of Class II Restorations Using Two Restorative Materials
Molina G, Frencken J, Ulloque M, Mulder J, Menezes-Silva R, Navarro M
J Dent Res 2020 Vol. 99 Spec Iss A: #1385.

This study compared the cumulative survival percentages of class II restorations prepared with the Atraumatic Restorative Treatment method (ART) using EQUIA and the traditional method using the resin composite Filtek Z250. After 3 years, cumulative survival percentages of Class II restorations for ART were 96.4 and 97.6, and 92.9 and 94.1 for the traditional method, respectively. No differences were found between the techniques. EQUIA in combination with the ART method may be viable alternative to the traditional amalgam for class II restorations.

Clinical performance during 48 months of two current glass ionomer restorative systems with coatings: a randomized clinical trial in the field.
Klinke T, Daboul A, Turek A, Frankenberger R, Hickel R, Biffar R.
Trials. 2016 May 8;17(1):239.

Klinke et al. evaluated a total of 1001 fillings from either EQUIA (EQUIA Fil with its dedicated EQUIA Coat) or Fuji IX GP with a light-cured coating were placed by 111 dentists in 643 patients in a four-year prospective clinical field study. Both materials showed similar good overall performance in Class I cavities; for Class II restorations, the EQUIA system showed few failures at all follow-up intervals.

Clinical performance of a glass ionomer restorative system: a 6-year evaluation.
Gurgan S, Kutuk ZB, Ergin E, Oztas SS, Cakir FY.
Clin Oral Investig. 2017 Sep;21(7):2335-2343.

Gurgan et al. restored a total of 140 (80 Class 1 and 60 Class 2) cavities in 59 patients with either EQUIA or with the microfilled hybrid composite Gradia Direct Posterior in combination with a self-etch adhesive (G-BOND). Equia showed acceptable clinical performance according to modified USPHS criteria assessed in Class 1 and Class 2 cavities over the course of the six years.

A Prospective Six-Year Clinical Study Evaluating Reinforced Glass Ionomer Cements with Resin Coating on Posterior Teeth: Quo Vadis?
Türkün LŞ, Kanik Ö.
Oper Dent. 2016 Nov/Dec;41(6):587-598.

Türkün and Kanik evaluated the clinical performance of the EQUIA system and Riva SC coated with Fuji Varnish over six years using modified USPHS criteria. A total of 256 Class I and Class II restorations were placed in 54 patients. When comparing baseline to six years, the overall success of the EQUIA system was better than Riva SC with Fuji Varnish, in which problems occurred with regard to retention rate and anatomical form.

7 Years, Multicentre, Clinical Evaluation on 154 permanent Restorations made with a glassionomer-based restorative system.
Basso M, Goñe Benites JM, Ionescu A, Tassera C.
J Dent Res 2016 Vol. 95 Spec Iss B: #0446.

Basso et al. evaluated 154 EQUIA restorations placed in 124 patients. At 7 years of follow-up an overall success rate of 72.4% was found. Incidence of lost restorations seemed to be influenced by the number of cavity walls.

A randomized controlled 10 years follow up of a glass ionomer restorative material in class I and class II cavities.
Gurgan S, Kutuk ZB, Yalcin Cakir F, Ergin E.
J Dent. 2019 Jul 25. pii: S0300-5712(19)30157-5.

Gurgan et al. restored a total of 140 (80 Class 1 and 60 Class 2) cavities in 59 patients with either EQUIA or with the microfilled hybrid composite Gradia Direct Posterior in combination with a self-etch adhesive (G-BOND). EQUIA showed acceptable clinical performance according to modified USPHS criteria assessed in Class 1 and Class 2 cavities over the course of the ten years, with a calculated cumulative failure rate of 3.17%.

Multi-Center Clinical Evaluation of Bulk-Fill Glass Hybrid Restorations: One-year Report
Türkün LŞ, Atalayin Ç, Baraba A, Basso M, Giovannardi M, Marcovic D, Peric T, Miletić I.
J Dent Res 2018 Vol. 97 Spec Iss B: #1972.

180 patients received two restorations of moderate to large Class II cavities, either with EQUIA Forte or with Tetric EvoCeram at dental universities in 4 different countries. The restorations were evaluated according to FDI criteria. After one year, no significant differences were found between both materials regarding aesthetic, functional and biological properties.

Clinical Performance of a Glass-Hybrid System Compared with a Resin Composite in the Posterior Region: Results of a 2-year Multicenter Study
Miletić I, Baraba A, Basso M, Pulcini MG, Marković D, Perić T, Atalayin Ozkaya C, Turkun LS.
J Adhes Dent 2020; 22: 235–247.

In this report, the two-year results of all 4 participating dental universities are published. In total, 360 restorations were placed in 180 patients (split-mouth approach) from 4 different countries. There were no significant differences in the survival rates or in any of the evaluated esthetic, functional or biological properties between the glass hybrid EQUIA Forte and nano-hybrid composite restorations. Both restoratives showed good clinical performance in moderate to large two-surface Class-II restorations after 2 year follow-up.

48-Month Clinical Performance of a Glass-Hybrid in Extended-Size Class-II Cavities
Gurgan S, Kutuk ZB, Ozturk C, Soleimani R.
J Dent Res 2020 Vol. 99 Spec Iss A: #1389.*

Gurgan et al. evaluated the clinical performance of a glass hybrid (EQUIA Forte) and compared with the performance of a resin composite (G-ænial Posterior). After a 4-year follow-up period, the authors concluded that EQUIA Forte can be considered as a permanent restorative material for the restoration of large Class II cavities.
*Results after two years published in: Gurgan S, Kutuk ZB, Ozturk C, Soleimani R, Cakir FY. Clinical Performance of a Glass Hybrid Restorative in Extended Size Class II Cavities. Oper Dent. 2019 Oct 29.

5.1.2. In vitro evidences

Comparison of Compressive Strength and Fluoride Release of GIC Restoratives.
Mori D.
J Dent Res 2020, Vol. 99 Spec Iss A: #1856.

The compressive strength of Equia Forte HT was evaluated in different time intervals (30 min, 24h, 7 days) and compared to the compressive strength of other restorative materials (EQUIA Forte Fill, Ketac Universal, Riva Self cure, ChemFil Rock). Equia Forte HT had the highest compressive strength in all time intervals, what suggests it is suitable material for long term posterior restorations.

Compression Fracture Resistance of Four Different Glass-ionomer Cements
Glavina D, Gorseta K.
J Dent Res 2020, Vol. 99 Spec Iss A: #1284.

This study compared the fracture resistance to compression of four different GIC/GH materials filled in Class II type cavities (Fig. 20), resulting in significantly higher values for EQUIA Forte and EQUIA Forte HT.
(EquiaForte 257,2N; EquiaForte HT 245,3N; KetacMolar 140,7N; IonostarMolar 114,5N. Type of the fracture was cohesive in all cases).

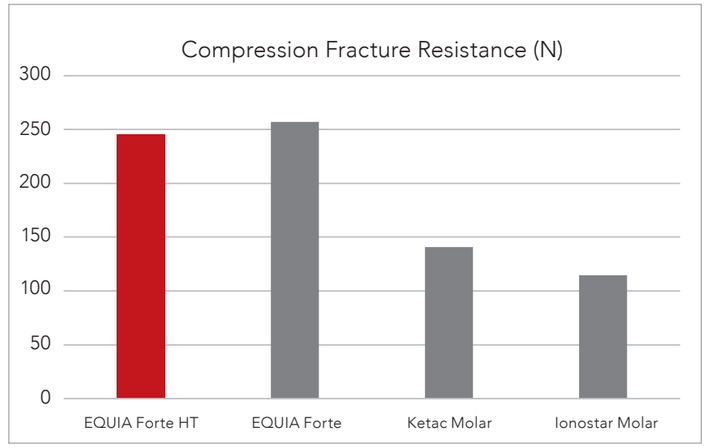


Figure 20: Compression fracture resistance of 4 different restoratives. Source: Glavina *et al.*, 2020)

Compressive Strength, Microhardness, Acid Erosion of Restorative Glass Hybrid/ Glass-ionomer Cements
Navarro M, Rocha R, Tsuzuki F, Baesso M, Borges AF, Bresciani E, Pascotto R, Menezes-Silva R.
J Dent Res 2020 Vol. 99 Spec Iss A: #1310.

The compressive strength and microhardness of EQUIA Forte HT were evaluated and compared to the values obtained for Ketac Molar. Results showed superior values for EQUIA Forte HT.

Mechanical and Optical Properties of a Novel Bulk Fill Glass Hybrid Restorative Dental Material
Shahrooz S, Pouraghaei S, Moshaverinia A, Ansari S.
J Dent Res 2020 Vol. 99 Spec Iss A: #3382.

The flexural strength and surface hardness of EQUIA Forte HT were evaluated. The outstanding performance of Equia Forte HT suggests this material might have a wide range of clinical applications.

Mechanical performance of a newly developed glass hybrid restorative in the restoration of large MO Class 2 cavities.
Kutuk ZB, Ozturk C, Cakir FY, Gurgan S.
Niger J Clin Pract. 2019 Jun;22(6):833-841.

The compressive strength and fracture resistance (Fig. 21) of EQUIA Forte was compared with a microhybrid composite (G-aenial Posterior).
EQUIA Forte presented very good mechanical properties, making it suitable to restore extensive caries lesions on posterior teeth.

Compressive strength

	EQUIA Forte	G-ænial Posterior
Mean (MPa)	164.62 (±25.72)	278.2 (±17.34)

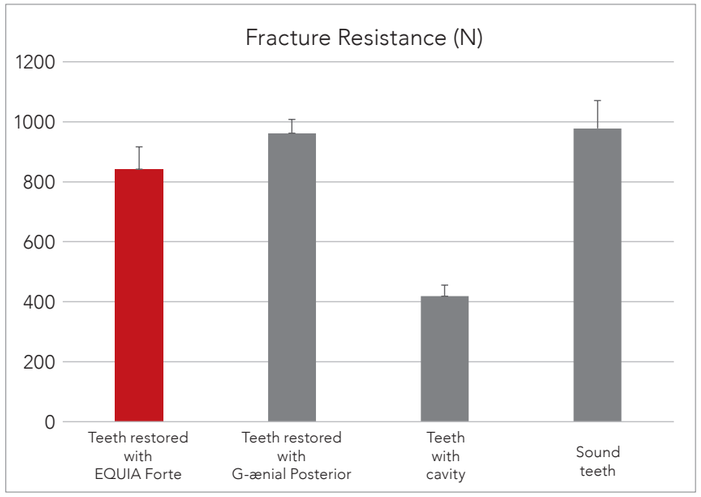


Figure 21: Fracture resistance of restored teeth.
Source: Kutuk *et al.*, 2019.

Comparative evaluation of the physical properties of a reinforced glass ionomer dental restorative material.
Moshaverinia M, Navas A, Jahedmanesh N, Shah KC, Moshaverinia A, Ansari S.
J Prosthet Dent. 2019 Aug;122(2):154-159.

ChemFil Rock exhibited significantly lower compressive strength and microhardness than EQUIA Forte. What was also interesting to see is that these types of materials (glass ionomers and glass hybrids) demonstrated a significant improvement in their mechanical properties after 1 week of immersion in distilled water.

In vitro investigation of antimicrobial effects, nanohardness, and cytotoxicity of different glass ionomer restorative materials in dentistry.
Coşgun A, Bolgul B, Duran N.
Niger J Clin Pract. 2019 Mar;22(3):422-431.

The nanohardness - among other properties - of several materials was tested.

EQUIA Forte presented superior hardness values, contributing to a high wear resistance in high occlusal loads areas.

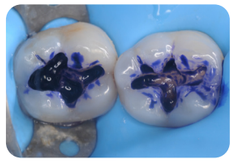
Nanohardness

	EQUIA Forte	ARGION	Fuji IX GP capsule	Fuji II LC capsule	ZIRCONOMER
Median (GPa)	0.694	0.389	0.369	0.807	0.148
Minimum (GPa)	0.091	0.053	0.015	0.354	0.026
Maximum (GPa)	2.797	2.96	3.044	2.797	0.505

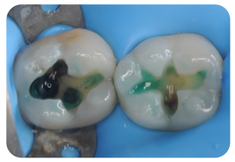
5.1.3 Clinical case amalgam replacement

EQUIA Forte HT can be placed in bulk and is easy to pack & contour. It only takes 3'25" to complete your restorations, which makes it a suitable alternative to amalgam within its indication field.

1. Initial situation

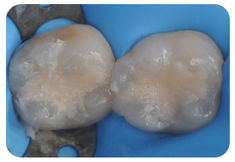


2. Caries detection

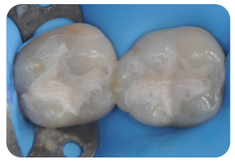


3. Application of cavity conditioner

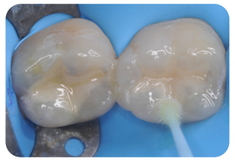
4. The dentine is not overdried but kept slightly moist



5. After placement of EQUIA Forte HT



6. After making adjustments



7. Application of EQUIA Forte Coat

8. Final Result

Courtesy of Dr. Victor Cedillo Felix, CA, USA

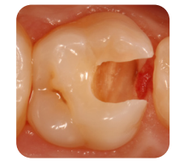
5.2 Wide range of indications

5.2.1 Class I and II

For the clinical trials in Class I and Class II cavities, please see Chapter 5.1.
In the clinical case below, it can be seen how a deep caries lesion in a Class II, load-bearing cavity was restored minimally invasively with EQUIA Forte HT (Courtesy of Dr. Zeynep Bilge Kütük, Turkey).

1. Initial situation

2. Initial radiograph



3. Cavity after caries removal

4. Placement of anatomical matrix system

5. Application of cavity conditioner

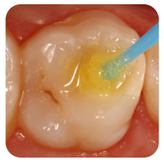
6. Thorough rinsing

7. Dentine is nog overdried

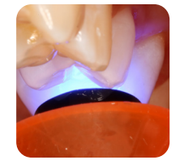
8. Application of EQUIA Forte HT

9. After application

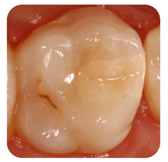
10. After adjestments



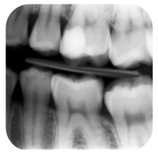
11. Application of EQUIA Forte Coat



12. Light-curing of the coating



13. After treatment



14. Radiograph after treatment

Courtesy of Dr. Zeynep Bilge Kütük, Turkey

5.2.2. Class V

Glass hybrid versus composite for restoration of non-carious cervical lesions.
Göstemeyer G, Jeggle, LM, Seifert T, Paris S, Schwendicke F.
J Dent Res 2019 Vol. 98 Spec Iss A: #3725.

The survival of glass hybrid EQUIA Forte was compared to the nano-hybrid composite Filtek Supreme XTE in sclerotic Class V lesions over a course of 18 months. 88 patients with 175 randomly received restorations with either one of the tested materials. Higher age of patients and location of the restoration in the mandible were associated with an increased risk of failure. The treatment time was significantly shorter with glass hybrids, while the survival of both materials was not significantly different.

Twenty-four-month clinical performance of a glass hybrid restorative in noncarious cervical lesions of patients with bruxism: a split-mouth, randomized clinical trial.
Koc Vural U, Meral E, Ergin E, Gürgan S.
Clin Oral Investig. 2019 Jul 11.

Koc Vural et al. evaluated 148 Class V lesions in 25 patients with bruxism over a period of two years. The teeth were randomly restored with either EQUIA Forte or Ceram.X One Universal. No significant difference was found between the materials for retention and no relationships were found between internal angle, depth, cervico-incisal height, or mesio-distal width and retention of the restorations. Neither secondary caries nor tooth sensitivity was observed on any of the restorations at any evaluation.

5.3 Suitable for all generations

5.3.1 Pediatric dentistry

Because of their quick and easy bulk placement, glass hybrids are particularly useful for restorations in children and patients who need special care.

Randomized Clinical Trial of ART Class II Restorations Using Two Glass Ionomer Cements: One-Year Follow-Up.
de França Lopes CMC, Schubert EW, Martins AS, Loguercio AD, Reis A, Chibinski ACR, Wambier DS.
Pediatr Dent. 2018 Mar 15;40(2):98-104.

Over a period of 12 months, De França Lopes *et al*. compared the survival rate of 59 Class II ART restorations in primary teeth of 33 children, which were made either with GP Glass fill (glass carbomer) or the EQUIA system.
At 12 months, the overall success rates of EQUIA and GP Glass Fill were 86% and 56% percent, respectively; this difference was statistically significant.
Class II ART restorations with glass carbomer showed lower survival rates after 12 months compared to those with the EQUIA system.

Bilayer technique and nano-filled coating increase success of approximal ART restorations: a randomized clinical trial.
Hesse D, Bonifácio CC, Guglielmi Cde A, Bönecker M, van Amerongen WE, Raggio DP. Int J Paediatr Dent. 2016 May;26(3):231-9.

Hesse *et al.* evaluated Class II restorations placed with four techniques in primary molars from 208 schoolchildren. The restorations survival after three years was 52.8%. Bilayer restorations and restorations with EQUIA had a significantly higher survival than uncoated glass ionomer restorations.

5.3.1.1 Special care dentistry

High-viscosity glass-ionomer vs. composite resin restorations in persons with disability: Five-year follow-up of clinical trial.
Molina G, Faulks D, Mulder J, Frencken J.
Braz. Oral Res. 2019;33:e099.*

Molina et al. assessed the 5-year cumulative survival rate of atraumatic restorative treatment and conventional resin composite restorations placed in young patients with disability. Patients referred for restorative care to the Haemophilia Foundation special care service were treated by one of two specialists. 298 dentine carious lesions were restored in primary and permanent teeth of 66 patients with 16 different disability profiles. The 5-year cumulative survival rates for the 182 ART and 116 CRT restorations were 90.2% and 82.8%, respectively.

*Three-year results published in: Molina GF, Faulks D, Mazzola I, Cabral RJ, Mulder J, Frencken JE.
Three-year survival of ART high-viscosity glass-ionomer and resin composite restorations in people with disability. Clin Oral Investig. 2018 Jan;22(1):461-467.

5.3.1.2 Molar Incisor Hypomineralisation (MIH)

The occurrence of MIH in children is on the rise. These teeth are particularly difficult to treat due to difficulties to numb them and retention of resin-based material is low.

Clinical Performance of Restorations in Teeth Affected by MIH
Kaya R, Kargul B.
J Dent Res 2021 Vol. 100 Spec Iss A: #0584.

Kaya et al. evaluated the performance of EQUIA Forte HT placed on 37 first permanent molars affected by MIH. At 12-month follow-up period, retention rate was 100% while marginal integrity was 89.2%. No changes were found on the anatomical form and marginal discoloration.

High-Viscosity Glass Ionomer Used With Selective Cavity Preparation in MIH
Sezer B, Tugcu N, Caliskan C, Durmus B, Kargul B.
J Dent Res 2019 Vol. 98 Spec Iss B: CED-IADR#0568.

Sezer et al. assessed the clinical performance of the EQUIA Forte system in selectively prepared cavities in the treatment of MIH affected molars. 134 first permanent molars affected by severe MIH were restored with EQUIA Forte in 58 patients. The carious removal process followed the principles of Minimum Intervention Dentistry, where the tissue was removed selectively, depending on the cavity depth. Restorations were

evaluated using the Modified USPHS criteria. The probability of satisfactory scores at 12 months and 24 months were found to be 88.2% and 78.6%, respectively. No statistically significant difference in satisfaction comparison rate was found between 12 and 18 months. It was concluded that EQUIA Forte has a high survival rate in teeth with MIH after two years.

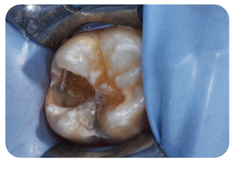
ART Restorations In MIH Severely Affected Molars: 4 Years Follow up
Marques M, Santana I, Cabral R, Grossi J, Leal S.
J Dent Res 2020 Vol. 99 Spec Iss A: #2384.*

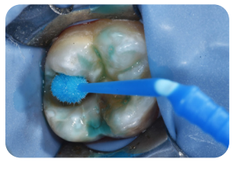
Marques et al. assessed the clinical performance of ART restorations using a highviscosity glass hybrid restorative system ionomer cement in first permanent molars severely affected with molar-incisor hypomineralisation (MIH). 44 children participated in this study. 60 restorations were performed under the ART protocol using EQUIA Forte. After a 4-year evaluation period, EQUIA Forte proved to be a reliable option for restoring severely MIH affected teeth.
*Results after two years published in: Grossi JA, Cabral RN, Ribeiro APD, Leal SC. Glass hybrid restorations as an alternative for restoring hypomineralized molars in the ART mode. BMC Oral Health. 2018 Apr 18;18(1):65.

Clinical case of MIH treatment

Unlike resin-based materials, glass hybrids can chemically bond equally well to both prismatic and aprismatic enamel and are more moisture tolerant, which could be a benefit in case of increased organic content (as is the case in MIH).


1. Initial situation

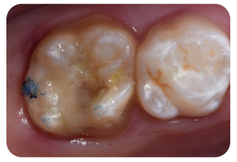

2. After cavity preparation


3. Application of cavity conditioner

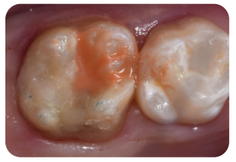

4. Cavity conditioner


5. Application of EQUIA Forte HT


6. After adjustments


7. Occlusion check


8.Application of EQUIA Forte Coat


9. Final result (including a sealing with Fuji TRIAGE Pink mesially

Courtesy of Dr. Patrick Rouas, France

5.3.2 Gerodontology

Older patients often present with restorative challenges such as salivary disfunction, root caries, general health problems and restrictions on oral care options.

Courtesy of Matteo Basso, Italy

Partial denture clasps are sites of higher risk for plaque accumulation. As a consequence, the caries risk is increased.

Courtesy of Dr. E. Stephen Vouliotis, Australia

5.4 Cost effectiveness scientifically proven.

While composites have advantageous physical properties, such as high flexural strength, their use is technically demanding. Glass hybrids, however, have several advantages, including lower costs. In these trials, it was shown that they were also cost-effective for a longer period of time.

Cost-effectiveness of glass hybrid versus composite in a multi-country randomized trial
Schwendicke F, Gomez JR, Krois J, Basso M, Peric T, Turkun LS, Miletić I. J Dent 2021, Vol. 107:103614.

In this study, glass hybrid (EQUIA Forte Fil/EQUIA Forte Coat) was tested against an established composite material (Tetric EvoCeram) for the restoration of two-surface, occlusal–proximal load-bearing restorations. This was a randomised controlled split-mouth clinical trial on 180 patients in four different countries. University clinics in Croatia, Serbia, Italy and Turkey participated. It was concluded that glass hybrids were less costly than composites, both initially and over 3 years. Efficacy differences were extremely limited.

Glass hybrid versus composite for non-carious cervical lesions: Survival, restoration quality and costs in randomized controlled trial after 3 years
Schwendicke F, Müller A, Seifert T, Jeggle-Engbert L-M, SebastianParis S, Göstemeyer G.
J Dent 2021, Vol. 110:103689.

This study compared survival, restoration quality and costs of glass hybrid (EQUIA Forte Fil/EQUIA Forte Coat) and composite restorations (OptiBond FL/Filtek Supreme XTE) of sclerotic non-carious cervical lesions. Within this trial, survival was not significantly different between glass hybrids and composites to restore sclerotic non-carious cervical lesions. As glass hybrids were significantly less costly both initially and long-term than composites, using composite was only cost-effective for patients willing to invest high additional expenses per minimal survival gains.

Long-term cost-effectiveness of glass hybrid versus composite in permanent molars
Schwendicke F, Basso M, Markovic D, Turkun LS, Miletić I. J Dent 2021, Vol. 112:103751

The long-term cost-effectiveness of glass hybrid (GH) versus composite (CO) for restoring permanent molars was assessed using a health economic modelling approach. Data was extracted from a multi-national (Croatia, Serbia, Italy, Turkey) split-mouth randomized trial comparing GH and CO. Using Markov modelling, molars were followed over the lifetime of an initially 12-years-old individual, concluding that GH were more effective and less costly.

5.5 Glass Hybrids scientifically recognized as a new class of restorative material.

Carious Lesions and First Restorative Treatment
Adopted by FDI General Assembly September, 2019 in San Francisco, United States of America. International Dental Journal 2020; 70: 5–6.

FDI recognizes Glass Hybrids as a class of restorative materials for single surface cavities and Class II restorations of permanent teeth.

Commercially Available Ion-Releasing Dental Materials and Cavitated Carious Lesions: Clinical Treatment Options
Slimani A, Sauro S, Gatón Hernández P, Gurgan S, Turkun LS, Miletic I, Banerjee A, Tassery H. Materials 2021, 14, 6272.

Glass Hybrids are recognized as an ion-releasing biomaterial, with antibacterial effects, hard tissues remineralization capacity and bulk-fill reaction.

6 Handling

6.1 Step-by-step

Apply petroleum jelly or GC Cocoa butter inside the matrix.

Use anatomically shaped wedges for better adaptation and contact points.

Use tight rings from sectional matrix systems, acting as a teeth separator to ensure good contact points.

OPTIONAL STEP:
Apply Cavity Conditioner (10 sec.) or
Dentin Conditioner (20 sec.).

Rinse and gently dry, do not dessicate

Shake or tap to loosen powder

Depress plunger.
Hold down firmly for 2 sec.

Mix for 10 sec.
Working time is 1 min. 30 sec. from start of mix

Insert on Capsule Applier, click twice to prime capsule.

IMMEDIATELY dispense within 10 sec.

Pack and contour. Avoid moisture contamination and dry-out.

Ensure complete set of EQUIA Forte HT Fil and carefully remove the ring. Use a probe to separate the bond between matrix and EQUIA Forte HT Fil.

Final finishing after 2 min. 30 sec. from start of mix.

Finish the restoration by applying the EQUIA Forte Coat.

Light cure for 20 sec.

Note: Steps except for 1,2,3 and 12 are the same for Class I and II.

6.2 Procedure time

	EQUIA Forte	EQUIA Forte HT	Ketac Molar Quick Aplicap	Ketac Universal Aplicap
Working time	1'15"	1'30"	1'40"	1'50"
Net setting time	2'00"	2'00"	3'30"	3'40"
Finishing time	2'30"	2'30"	3'30"	

The working time and setting time of EQUIA Forte HT were optimised to enable comfortable placement.

6.3 Tips and tricks

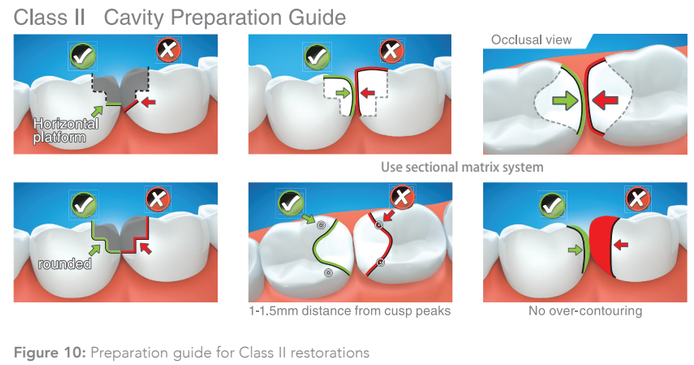
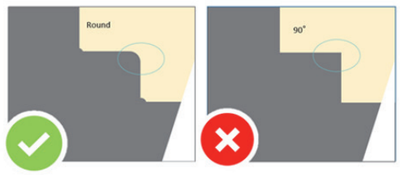


Figure 10: Preparation guide for Class II restorations

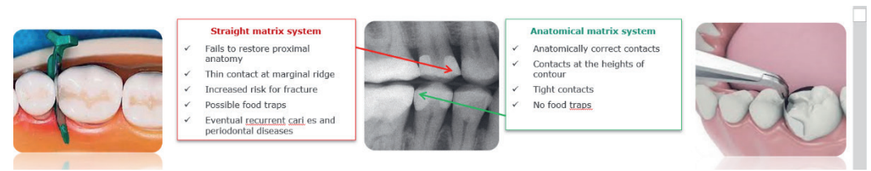
TIP 1

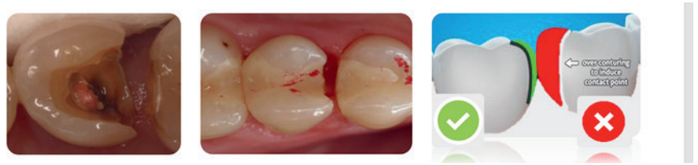
During cavity preparation, consider to eliminate all sharp edges inside the cavity.



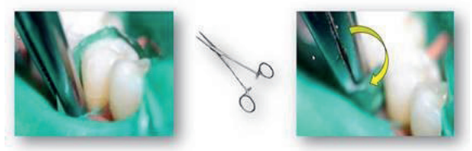
TIP 2

Use anatomical matrix systems instead of straight matrix systems to ensure the correct shape of the proximal surface and an adequate contact point. Approximately 15% more force is needed to fracture fillings done with sectional matrix system and rounded internal cavity angles. (Source: Basso et.al, 2015, IADR abstract # 3532)





TIP 3
Avoid overcontouring of restorations when the gap between two teeth is too wide. Glass hybrids should not be used for those indications.



TIP 4
A mosquito tweezer can be used and remove the matrix buccally instead of pulling it up through the marginal ridge. This will prevent the restorative material from chipping at the proximal area.

Notes