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CASE STUDY

Abfraction Lesion Restorations:

A Minimally Invasive, Adhesive-Driven Approach

Dr. Daniel Vasquez
Oceanside, CA

KEY HIGHLIGHTS

- Proven color stability of CLEARFIL MAJESTY™ flowable composites
- High polishibility and excellent polish retention
- Exceptional blending
- Unique chemistry, LCSi, provides low water sorption and low water solubility
- CLEARFIL™ adhesives have exceptional, proven long-term results with cervical lesions

CASE SUMMARY

This case will explore completed abfraction lesion restorations with CLEARFIL™ Universal Bond Quick 2, CLEARFIL MAJESTY™ Flow, and CLEARFIL MAJESTY™ ES (Esthetic) Flow. There is an abundance of long-term clinical studies on non-carious cervical lesions (NCCLs). These clinical research papers have been summarized in a meta-analysis that was published in *Dental Materials.* This meta-analysis covering 63 years of clinical studies[1] provides clinicians with several proven clinical guidelines that answer many questions.

Some of the questions answered include the following:

1. Does the type of composite used for cervical lesions make a difference in clinical outcomes?
2. What types of adhesives have the best clinical outcomes?

Images and Dentistry
by Dr. Daniel Vasquez

Case Formatted
by Dan Clementino
and Andrew Goodman

Abstract

NCCLs, commonly associated with abfraction, present a restorative challenge due to their multifactorial etiology and compromised dentin substrate. This case report demonstrates a minimally invasive, adhesive-driven approach utilizing modern universal adhesive systems and a layered composite technique. Emphasis is placed on biomechanical understanding, surface preparation, resin coating, and material selection to enhance long-term clinical success, esthetics, and patient comfort.

Introduction

Abfraction lesions are characterized by the loss of tooth structure at the cemento-enamel junction (CEJ), often presenting as wedge-shaped defects. These lesions are associated with occlusal stress, tooth flexure, abrasion, and erosion, making their management complex.

Restoration of NCCLs requires:

- Preservation of tooth structure
- Reliable adhesion to sclerotic dentin
- Resistance to flexural stress
- Long-term esthetic stability

Discussion

The successful restoration of NCCLs requires addressing both mechanical and adhesive challenges. These lesions are not purely structural defects but represent a combination of biomechanical and environmental factors.

Key factors influencing success include the following:

1. Adhesive Strategy
Universal adhesives containing MDP monomer provide reliable bonding to both enamel and dentin. Studies show comparable outcomes between total-etch, selective-etch, and self-etch techniques when proper protocols are followed.

2. Substrate Management
Sclerotic dentin presents a significant bonding challenge. Air abrasion, abrading with a diamond, and active adhesive application improve surface conditions and enhance hybrid layer formation, resulting in improved bond performance.

3. Resin Coating Technique

The application of a thin layer (0.5 to 1 mm) of a flowable composite liner as a stress-absorbing layer protects the adhesive interface and improves long-term bond durability and has been shown to insulate the pulp.[2] This is particularly important in high-stress cervical regions as well as deep occlusal restorations.

4. Material Selection

CLEARFIL MAJESTY™ ES Flow demonstrates excellent color stability due to its proprietary LCSi filler treatment technology, which reduces water sorption and solubility. Studies have shown low discoloration values over time,[3] supporting its use in esthetic zones.

5. Occlusal Considerations

Failure to address occlusal loading may compromise restoration longevity. Evaluation and management of parafunctional habits are essential components of treatment planning.

1

PRE-OPERATIVE PRESENTATION: ABFRACTION LESIONS (TEETH NOS. 3 TO 6)

A 45-year-old male patient presented with a preoperative intraoral view of the maxillary right quadrant demonstrating multiple non-carious cervical lesions (NCCLs) affecting teeth Nos. 3 to 6. The lesions present with characteristic, wedge-shaped morphology and well-defined margins consistent with abfraction. Associated gingival recession exposes root dentin, contributing to dentin hypersensitivity and increased food and plaque retention.

2

OCCLUSAL WEAR PATTERNS AND FUNCTIONAL STRESS

Occlusal view of the maxillary right quadrant, demonstrating generalized wear facets across posterior dentition. The presence of flattened occlusal surfaces and enamel wear is indicative of chronic occlusal loading and possible parafunctional activity. These findings support a biomechanical contribution to the development of cervical abfraction lesions.

3

PRE-RESTORATIVE MANAGEMENT, INITIAL PREPARATION, AND SENSITIVITY MANAGEMENT

Pre-restorative intraoral view following initial cleaning of NCCLs on teeth Nos. 3 to 6. The lesions exhibit exposed dentin and gingival recession. Due to significant hypersensitivity to air and thermal stimuli, local anesthesia was administered to ensure patient comfort during the adhesive restorative procedure. No aggressive mechanical preparation was performed.

4

TISSUE MANAGEMENT, ISOLATION, GINGIVAL RETRACTION AND FIELD CONTROL

This clinical image demonstrates placement of an epinephrine-impregnated retraction cord to achieve gingival displacement and control of crevicular fluid. This step enhances visibility and access to the cervical margins, allowing for improved adhesive protocol execution in NCCL restorations.

The use of epinephrine retraction cord is preferred when working with self-etch adhesive systems, as hemostatic agents, such as ferric sulfate and aluminum chloride may contaminate dentin and negatively affect bond strength. Epinephrine does not interfere with dentin adhesion, making it a more favorable option in these cases.

Selection of Retraction Cord and Hemostatic Considerations

Pascal RetraxCord (epinephrine-based) was utilized for gingival retraction in this case. Size 00 was selected for atraumatic displacement.

Epinephrine-based systems provide effective hemostasis without contaminating dentin surfaces, making them particularly suitable when using self-etch or selective-etch adhesive strategies in cervical restorations.

Hemostatic agent selection plays a critical role in adhesive success, particularly in cervical restorations where dentin bonding is already challenging. Ferric sulfate and aluminum chloride hemostatic agents can adversely affect dentin bonding by leaving residues that interfere with chemical bonding, especially when using self-etch systems. In contrast, epinephrine-based agents do not chemically interact with dentin, making them a safer and more predictable option.

5

AIR ABRASION FOR SURFACE DECONTAMINATION AND ADHESION ENHANCEMENT

Air abrasion performed using 50-µm aluminum oxide particles to decontaminate the cervical lesion surfaces prior to adhesive application. This step effectively removes biofilm and surface debris, increases surface energy, and improves chemical bonding and retention, thereby enhancing bond strength to sclerotic dentin commonly found in non-carious cervical lesions. Sclerotic dentin presents a highly mineralized, hyperdense surface that can compromise adhesion. Air abrasion or abrading with a diamond helps modify this substrate, improving bonding predictability.

6

FINAL SURFACE CONDITION AFTER AIR ABRASION

Postoperative view following air abrasion of teeth Nos. 4 to 6 using 50-µm aluminum oxide. The cervical lesions demonstrate clean, decontaminated surfaces with preserved tooth structure. This step ensures optimal conditions for adhesive infiltration and bonding to sclerotic dentin. Achieving a clean and uncontaminated dentin surface is critical for predictable adhesion, particularly in NCCLs where bonding substrates are inherently compromised. There is no aggressive tooth reduction performed. This is the optimal substrate for adhesive bonding.

7

ADHESIVE STRATEGY: TOTAL-ETCH TECHNIQUE

In this case, the total-etch technique on teeth Nos. 3 to 6 prior to adhesive placement was used. This approach enhances enamel etching and improves marginal integrity while preparing dentin for bonding with a universal adhesive system.

Any etching mode may be utilized with CLEARFIL™ Universal Bond Quick 2 (self-, selective-, and total-etch). Multiple clinical studies show that CLEARFIL™ adhesives perform just as well in cervical lesions with different etching modes. The selection of the etching mode is entirely up to the clinician and all have been shown to provide the same level of efficacy with CLEARFIL™ adhesives due to the unique chemistry and pH.

8

APPLICATION OF UNIVERSAL ADHESIVE SYSTEM

Application of CLEARFIL™ Universal Bond Quick 2 using a micro-applicator to the prepared cervical lesions on teeth Nos. 3 to 6. The adhesive was actively rubbed into the dentin surface for 5 to 10 seconds to enhance infiltration, followed by gentle air drying to evaporate solvents and achieve a stable adhesive layer prior to light curing. Active application of the adhesive improves penetration into sclerotic dentin and enhances hybrid layer formation, which is critical for long-term bond durability in NCCLs.

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LIGHT POLYMERIZATION OF ADHESIVE LAYER

Light curing of the applied adhesive (CLEARFIL™ Universal Bond Quick 2) for 10 seconds ensures complete polymerization of the bonding layer. Proper curing is essential for the formation of a stable hybrid layer and optimal adhesion to both enamel and dentin substrates. Adequate polymerization of the adhesive layer is essential to maximize bond strength and prevent early restoration failure in high-stress cervical areas. This helps prepare the surface for composite placement.

10

RESIN COATING WITH FLOWABLE COMPOSITE

Placement of a thin layer (approximately 0.5 mm) of CLEARFIL MAJESTY™ Flow as the initial restorative layer over the bonded dentin surfaces. This “resin coating” technique protects the adhesive interface from polymerization stress, enhances bond integrity, and provides a stress-absorbing layer prior to placement of subsequent composite increments.

The resin coating technique involves placement of a thin flowable composite layer over the adhesive to protect the hybrid layer, reduce polymerization stress, and improve long-term bond stability. It also enhances bond durability and reduces sensitivity.

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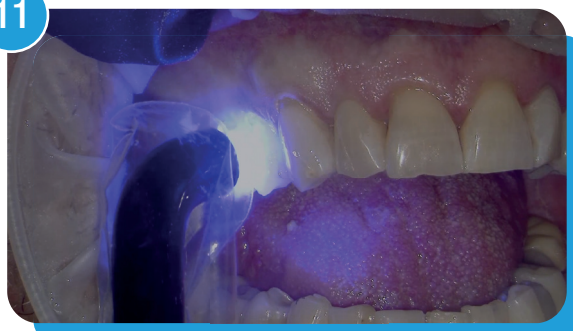

LIGHT CURING OF FLOWABLE RESIN COATING LAYER

Light curing of the initial flowable composite layer (CLEARFIL MAJESTY™ Flow) for 20 seconds following placement. This step ensures complete polymerization of the resin coating layer, creating a stress-absorbing interface and a stable foundation for subsequent composite layering. Adequate polymerization of the flowable liner is critical to ensure its function as a stress-relieving intermediary and to maintain long-term bond integrity.

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APPLICATION OF ESTHETIC FLOWABLE COMPOSITE LAYER

Application of CLEARFIL MAJESTY™ ES Flow as the final restorative layer over the previously polymerized resin coating. This filled flowable composite incorporates Light-Diffusing Technology to enhance optical blending with surrounding tooth structure, while its proprietary, silane-treated filler system contributes to long-term color stability and surface gloss retention. The use of a highly esthetic flowable composite in the final layer allows seamless integration with the natural tooth while maintaining adequate mechanical properties.

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LIGHT-CURING OF ESTHETIC COMPOSITE LAYER

Light curing of the final esthetic composite layer (CLEARFIL MAJESTY™ ES Flow) for 20 seconds ensures complete polymerization. Adequate curing is essential to achieve optimal mechanical properties, color stability, and long-term surface integrity of the restoration. Proper polymerization of the final composite layer is critical to achieving long-term esthetic stability and resistance to wear and discoloration.

14

FINISHING TO FINAL CERVICAL ANATOMY

Finishing of the composite restorations using a fine diamond bur that establishes proper cervical anatomy and refine restoration margins. Careful contouring ensures a smooth transition between restoration and tooth structure, promoting optimal esthetics and periodontal compatibility.

Proper contouring of cervical restorations is essential not only for esthetics, but also for maintaining gingival health and preventing plaque accumulation.

15

INITIAL POLISHING WITH FINE POLISHER

Initial polishing of the composite restorations using a Shofu Brownie fine polisher. This step refines the restoration surface following contouring, reducing surface irregularities and preparing the composite for final high-gloss polishing. Surface smoothness plays a critical role in reducing plaque accumulation and maintaining long-term gingival health in cervical restorations.

16

FINAL RESTORATIVE OUTCOME

Final postoperative view of restored non-carious cervical lesions on teeth Nos. 3 to 6. The restorations demonstrate proper cervical contour, smooth marginal adaptation, and seamless integration with the surrounding tooth structure. The use of a layered composite approach provides both functional durability and esthetic harmony.

Successful restoration of NCCLs requires a combination of proper diagnosis, adhesive protocol, material selection, and occlusal management to achieve long-term stability. Esthetic and functional rehabilitation has been achieved.

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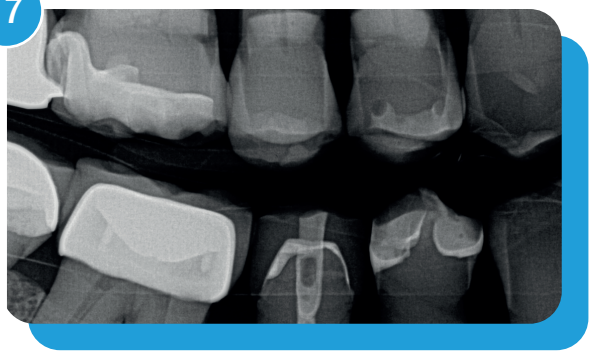

FINAL RESULTS

This image shows a postoperative x-ray.

PRODUCTS USED

CLEARFIL™ Universal Bond Quick 2
is a next-generation single-bottle universal adhesive powered by Urethane Tetramethacrylate (UTM) and Kuraray's proven MDP monomer. It enables zero-wait application with a uniform bond layer and reliable adhesion across all etching techniques.

CLEARFIL MAJESTY™ Flow
is a light-cure, super-filled, radiopaque restorative composite flowable resin that has excellent consistency and strength, very low shrinkage, extremely high filler loading (81 wt%), with an easy, smooth flow, bubble-free syringe dispenser.

CLEARFIL MAJESTY™ ES Flow
is a light-cure, universal, flowable composite, which can be used for the following applications: direct restorations for all cavity classes; cavity base/liner; tooth wear and erosion; reshaping teeth and intraoral repair of fractured restorations.

Conclusion

A minimally invasive, adhesive-driven approach to NCCL restoration can provide predictable, long-term clinical success when combined with proper diagnosis, material selection, and occlusal management.

The integration of advanced adhesive systems, resin coating techniques, and high-performance composite materials allows clinicians to achieve restorations that are both functionally durable and esthetically stable.

CLEARFIL MAJESTY™ ES composites have been proven to provide exceptional color stability and maintain their surface integrity. This has been noted by researchers and stems from the composite's unique and proprietary filler treatment chemistry (LCSi). This unique filler coating chemistry results in less water sorption and less water solubility. Clinically, this provides excellent color stability and excellent polish retention.[3-6]

When tested for color stability, the following was concluded: "CLEARFIL MAJESTY™ ES Flow showed the lowest means at every interval of measurement."[3]

CLEARFIL™ adhesives have shown exceptional clinical results in long-term research studies for many decades now. A systematic review of contemporary adhesives was published in 2014 and stated the following: "CLEARFIL™ SE showed the best bonding performance in NCCLs."[1]

This review also stated: "This high-quality bonding performance can be explained by the presence of the functional monomer 10-MDP … This chemical bonding promoted by 10-MDP is more effective and also more stable in water than that provided by other functional monomers like 4-MET and phenyl-P."

The original MDP monomer was developed and patented by Kuraray Co. Ltd. in 1981. The first products available with this unique adhesive monomer were CLEARFIL™ NEW BOND and the original PANAVIA™ EX resin cement in 1983. This unique, adhesive monomer in the right formulation creates an insoluble, chemical bond with the hydroxyapatite in dentin and enamel. It also creates a stable, chemical bond to air-abraded zirconia and oxidizing metals. Therefore, MDP is what provides clinicians with a one-of-a-kind universal adhesive.

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