

A Simple Technique to Repair Feldspathic Porcelain Chipping in Screw-retained Implant-supported Prosthesis: A Clinical Technique

Lenin Proaño¹, Rebeca K Silva², Ariadne CC Cruz³, Mutlu Özcan⁴, Claudia ÂM Volpato⁵

ABSTRACT

Aim: This clinical technique report aimed to describe a composite resin repair technique performed in an implant-supported prosthesis.

Background: Veneering ceramic fracture or chipping is one of the most frequent clinical failures in dentistry. Therefore, the use of less time- and cost-consuming ceramic repair techniques is helpful in clinical practice.

Technique: Briefly, to treat the ceramic surface, the glaze was removed at the margins of the fracture area, then, air-abrasion and acid-etching were performed. To promote chemical adhesion, a silane coupling agent and adhesive system were applied over the ceramic surface, and the composite resin was applied by incremental technique. Finally, the polish was performed.

Conclusion: In conclusion, the applied composite resin repair of feldspathic porcelain chipping in implant-supported prosthesis was a simple, easy, affordable, and minimally invasive treatment.

Clinical significance: The causes of veneer materials failures in metal-ceramic crowns are considered a challenge for the dentist and a problem that displeases patients. Repairs are indicated to prevent cracks from spreading and to prevent the accumulation of biofilm on the damaged surface. Therefore, different repair protocols have been proposed to enhance the esthetic, functionality, and longevity of the implant-supported prosthesis. Additionally, the success of the clinical cases depends on the capability to identify ceramic failures and the ability to indicate/perform the correct repair protocol. Since the described repair technique of the fractured screw-retained implant-supported prosthesis was a simple, easy, affordable, and minimally invasive treatment, with excellent esthetic and masticatory results, it represents an interesting clinical option.

Keywords: Composite resin, Dental prosthesis, Denture repair, Implant-supported prosthesis.

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BACKGROUND

Feldspathic porcelain has been commonly used in ceramic veneers of dental and implant-supported prostheses, mainly due to its esthetics, biocompatibility, and durability characteristics.^{1,2} Proper bonding between the infrastructure and the feldspathic porcelain is critical to the longevity of bilayer restorations.³ Additionally, failures, such as ceramic veneers fractures or chipping still occur due to different reasons, including stress, strains during chewing function, improper design of the infrastructure, trauma, defects regarding the material manufacture, and para functions like bruxism.¹⁻⁴

In fixed implant-supported prostheses, the masticatory load is about 8–10 times greater than natural teeth due to the lack of periodontal ligament proprioceptive receptors.⁴ Therefore, prosthetic rehabilitation with osseointegrated implants is very susceptible to mechanical failure.^{4,5} The main technical complications regarding implant-supported prostheses are fracture or loss of the retention screw, loss of resin covering the screw entrance, and fractures or, more frequently, ceramic chipping.^{6,7} Also, the most commonly reported complications in about 5-years follow-up were chipping of ceramic veneers (13.2%), followed by the loss of the covering resin (8.2%), and loss of the prosthetic screw or abutment (5.8%).^{6,8}

Replacement of the prostheses with failures described above is the most common option used by clinicians, but usually, it is the most costly and time-consuming alternative.⁹ Therefore, composite resin repairs have been reported as an interesting and minimally invasive approach for replacing the failed or fragmented part of the

^{1-3,5}Department of Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil

⁴Department of Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics and Dental Materials Science, University of Zürich, Zürich, Switzerland

Corresponding author: Ariadne CC Cruz, Department of Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil, Phone: +55 4837213407, e-mail: ariadne.cruz@ufsc.br

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restoration leaving the intact section in place.¹⁰ To assist clinicians to decide the most appropriate protocol for repairing or replacing a compromised prosthesis, a ceramic chipping classification was proposed, according to the three grades: (1) small material veneer chipping, (2) moderate material veneer chipping, and (3) severe failures in materials veneer prosthesis.¹¹ Grade 1 failures could be treated with polishing procedures. In grade 2, direct or indirect repair protocols could be used, whilst grade 3 failures lead to the replacement of the restoration following established replacement criteria.¹¹ Therefore, the porcelain failures can be treated with different options according to the failure extension, including the

polishing procedures until the replacement of the prosthesis. As mention above, in grade 2, the direct or indirect repair protocols could be used. Indirect protocols require the prosthesis remotion and the ceramic application on the fractured area at the laboratory or the preparation of the fractured area and molding. Thus, the indirect repair (like a ceramic veneer) is performed at the laboratory and cemented over the fractured area at the dental office. Both options described above are more expensive and time-consuming procedures than the direct protocols, as they involve laboratory procedures. Additionally, in the first option, cracks may occur in the old porcelain, as the prosthesis should be taken to the oven to sinter the new porcelain applied to the fractured area. Consequently, direct repair is a faster and easier clinical procedure and can be done in the dental office at the same appointment, without the laboratory steps.

Although different repair protocols have been proposed to enhance longevity, functionality, and esthetic, there is no agreement concerning the best clinical treatment over time.¹² Adhesion appears to be a key step regarding repair protocols due to the possibility of bonding the old surface to the new repair material.¹⁰ In this context, composite resin has been used for the restoration of feldspathic porcelain chipping.^{13,14} The ceramic surface is treated before repair by macro and micromechanical treatments, such as air abrasion and acid etching.^{3,9,10} Therefore, the purpose was to describe a simple composite resin repair technique in screw-retained implant prosthesis, which is less time-consuming compared to laboratory techniques, without additional cost for patients.

TECHNIQUE

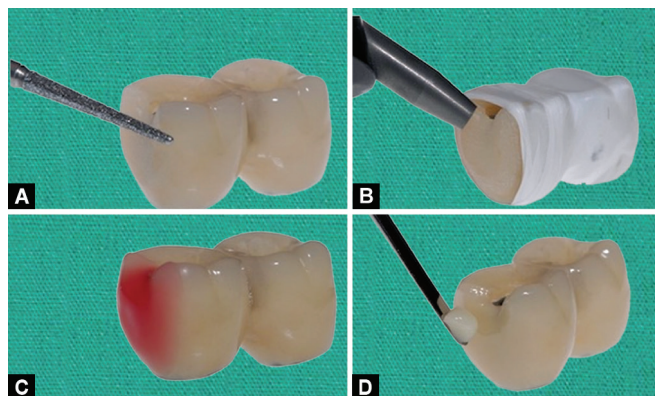
The patient showed feldspathic porcelain chipping in a screw-retained implant-supported prosthesis. The implant and the prosthesis were approximately 10 years old. The probable reason for the fracture was an occlusal overload since the patient lost teeth on the opposite side after the screw-retained implant-supported prosthesis was installed, which promoted an overloaded on the prosthesis. According to the ceramic chipping classification, a simple technique using composite resin could be chosen to repair this prosthesis (Fig. 1). The repair of the ceramic chipping was performed on a cast. Therefore, an impression of the prosthesis using transfer coping was performed to obtain an accurate cast. To achieve an appropriate aesthetic result, the selection of the composite resin shade was done using the color guide (Vita



Fig. 1: Fractured prosthesis in the mesial area



Fig. 2: Shade selection of composite resin using a color guide



Figs. 3A to D: (A) Glaze of ceramic veneer removed with a fine-grain diamond bur; (B) Sandblasting performed to remove the debris of the area and achieve a clean surface; (C) Hydrofluoric acid treatment; and (D) Silane coupling agent, adhesive system, and composite resin application

Classical, VITA Zahnfabrik, Bad Säckingen, Germany) (Fig. 2). Also, the fractured area was cleaned using a fluoride-free paste and a rubber cup while the prosthesis was out of the cast.

Afterward, to create a slight bevel on the remaining porcelain, the porcelain glaze was removed, especially at the margins of the failure (Fig. 3A).¹⁵ The remaining feldspathic porcelain was protected with polyfluorethylene tape. Sandblasting (Microtecher, Danville Engineering, Danville, IL, USA) was performed for 10 seconds with 50 µm silica particle size at 2.5 bar on the fractured area and the bevel, with circling motion (Fig. 3B). Subsequently, the area was cleaned with abundant water and dried thoroughly.¹³ The ceramic surface was etched with 10% hydrofluoric acid (Porcelain Etch, Dentsply, NY, USA) for 2 minutes (Fig. 3C). Afterward, the surface was cleaned with water for 1 minute (Fig. 4) and dried with oil-free air. To allow chemical adhesion, one coat of silane coupling agent (Monobond Plus, Ivoclar Vivadent, Schaan, Liechtenstein) was applied using a disposable brush on the etched surface. For solvent volatilization, it was waited for 1 minute and dried with oil-free air again.¹³ Adhesive system (Excite F, Ivoclar Vivadent, Schaan, Liechtenstein) was applied over the ceramic surface. Then, the surface was air-dried and photo-activated for 20 seconds. The composite resin (Empress Direct, Ivoclar Vivadent, Schaan, Liechtenstein) was applied using the incremental technique (Fig. 3D).



Fig. 4: Screw-retained implant prosthesis repaired was screwed back to the implants



Fig. 5: Composite resin repair after adjustments, finishing, and polishing

To confirm the dental contact, the prosthesis was placed back on the cast, and adjustments were performed (Fig. 5). The occlusion was verified. The composite resin was polished using rubber tips and disks with polishing pastes. Finally, the prosthesis was reinstalled over the implants applying the correct torque over the screws (Fig. 4) and the screw access was sealed with a composite resin material and polished once again.

The follow-up period after the porcelain repair was approximately 8 months. No failures or chipping off of the material was observed in this period.

DISCUSSION

The causes of veneer materials failures in metal-ceramic crowns are considered a challenge for the dentist and a problem that displeases patients.^{12,16} Repairs are indicated to prevent cracks from spreading and to prevent the accumulation of biofilm on the damaged surface.^{2,10} Therefore, different repair protocols have been proposed to enhance the esthetic, functionality, and longevity of the implant-supported prosthesis.¹⁰ In this context, the capability to identify failures, such as chipping, fracture, and cracks, as well as the ability to indicate the correct repair protocol may define the longevity of the repaired prostheses.^{6,11} In the present clinical technique, a veneer feldspathic porcelain chipping in screw-retained

implant-supported prosthesis was successfully repaired using a simple direct restoration procedure with a composite resin repair technique. The screw-retained implant-supported prosthesis was removed and the whole repair process was performed out of the mouth, on a stone cast to have a more accurate approach.

It is important to mention that the use of hydrofluoric acid and air-abrasion to condition the prostheses inside the mouth could represent a risk for teeth and soft tissues. Absolute isolation should be performed to protect the soft tissue from the hazardous effects of the hydrofluoric acid and to prevent saliva contamination and oral humidity during adhesive procedures.¹⁵ On the other hand, for screw-retained implant prostheses, due to their reversibility properties, clinicians can remove the prosthesis and perform the repair out of the mouth, using a stone cast, as we reported.

Additionally, when the repair protocol is performed directly, it may avoid distortions, and decrease clinical and laboratory time, and also could be a more conservative and affordable approach.^{9,17} The success of the direct repair technique is based on the correct and efficient application of the ceramic adhesive protocol.^{12,18} It is relevant to mention that prosthesis fractures involving metal, require specific adhesive protocols for metals, different from this case report.¹⁹ Hydrofluoric acid was used due to its properties of creating a surface conditioning in silica-based ceramics, dispensing more complicated techniques in the laboratory.¹⁷ All of these inconvenient effects were avoided herein by the reversibility characteristic of the screw-retained implant-supported prostheses. Therefore, in this report, a direct repair using composite resin was the most predictable technique indication.¹⁷

Increasing the bonding surface area and exposing silica particles could enhance bond effectiveness.³ Therefore, sandblasting with aluminum oxide is used to clean the ceramic surface and create micromechanical retentions. This approach can be combined with the use of a high-speed diamond bur to change the ceramic surface and increase its roughness.^{9,19} The silane coupling agent is used to provide effective adhesion between the composite resin and the ceramic.^{16,18} These agents are hybrid inorganic-organic bifunctional molecules able to create a siloxane network with the hydroxyl (OH) of silica in the ceramic surface, copolymerize with the resin matrix of composites, and help the penetration of the composite resin.^{12,17} Silane must be applied on the treated surface to create a chemical bonding between silica particles and composite resin. Moreover, silane use is considered an essential step to the adhesive protocol employing these materials.²⁰

It is important to highlight that the described simple and easy technique presents as a limitation to the fact that it is not effective for all the ceramic failures. Therefore, the success of the clinical cases depends on the capability to identify ceramic failures and the ability to indicate/perform the correct repair protocol.

CONCLUSION

In summary, the repair technique of the fractured screw-retained implant-supported prosthesis was a simple, easy, affordable, and minimally invasive treatment. Additionally, all procedures were performed in the dental office at the same appointment, with excellent esthetic and masticatory results.

CLINICAL RELEVANCE

The causes of veneer materials failures in metal-ceramic crowns are considered a challenge for the dentist and a problem that displeases patients. Repairs are indicated to prevent cracks from spreading

and to prevent the accumulation of biofilm on the damaged surface. Therefore, different repair protocols have been proposed to enhance the esthetic, functionality, and longevity of the implant-supported prosthesis. Additionally, the success of the clinical cases depends on the capability to identify ceramic failures and the ability to indicate/perform the correct repair protocol. Since the described repair technique of the fractured screw-retained implant-supported prosthesis was a simple, easy, affordable, and minimally invasive treatment, with excellent esthetic and masticatory results, it represents an interesting clinical option.

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