

Class IV Composite Restoration of Permanent Maxillary Central Incisor (Case Report)

Najhatul Muna^{1*}, Cahyani²

^{1,2}Department of Dentistry, Faculty of Dentistry, Universitas Muhammadiyah Surakarta, Indonesia
Corresponding author: js30225011@student.ums.ac.id

Abstract

Introduction: Dental fracture is a condition of fracture or partial loss of intact tooth structure caused by trauma or impact, usually occurring in the maxillary incisors. This restorative technique is a minimally invasive treatment for grade IV composite resin restorations that show a good color result. Composite resin can make restorations look worse over time, due to its color instability. The purpose of this article is to know how to make restorations on anterior teeth using composite resin materials. **Case report:** A 20 years old male visited RSGM Soelastri complaining of a fracture of his tooth, a diagnosis of ellis class II fracture and a treatment plan with a class IV composite resin restoration. Treatment was completed over several visits due to the use of additional mock-up. Control in a month showed that the color was aesthetically acceptable, no discoloration occurred, and the tooth did not fracture. **Conclusion:** The clinical effectiveness and the associated low failure rates with the composite resin freehand resurfacing technique with mock-ups makes it a great option for restoration of large class IV fractures.

Keywords: Restoration class IV, composite resin, dental fracture

Introduction Section

Dental fracture is a condition of fracture or partial loss of complete tooth structure (Novianthi Sidiartha and Yogananda Sutela, 2020), which negatively affects masticatory function, speech, and appearance (Soneta et al., 2021). The prevalence of permanent tooth fractures was found to range from 6.1% to 58.6% (Juneja et al., 2018). Based on gender, the ratio of the incidence of dental trauma in men to women is 2:1 because men has a greater potential for dental trauma than women (Farani and Nurunnisa, 2018).

Fractures of the anterior teeth are usually caused by trauma or impact due to sports activities or accidents, more often occurring in the maxillary incisors (Romero et al., 2017), then the maxillary lateral incisors and mandibular incisors (Sidiartha and Wiswananta P, 2020). The fracture extent can sometimes affect the clinical condition and also affect considerations in the choice of restoration materials to be used (Romero et al., 2017).

The placement of anterior composite resin restorations has become more simplified and systematic over the past few decades, largely due to the introduction of tooth structure replicating materials that are more aesthetic and natural (Vargas and Margeas, 2021). Restoration of anterior teeth emphasizes aesthetics, so it has its own challenges because it must meet several requirements such as color, shape, ratio, and size (Rauber et al., 2017);(Widya et al., 2020). The restoration material used is composite resin, which has advantages and disadvantages. The advantages of composite resin are that it is easy to repair, does not cause damage to the antagonist teeth, and is cheaper than indirect restorations. The disadvantages are color instability, limited depth of curing, and shrinkage during polymerization resulting in microleaks (Marufu et al., 2022). Therefore, dentists are recommended to be able to choose the materials used to meet the aesthetic needs of patients (Dewiyani, 2017).

Skinners (1991) defined composite as "a compound of two or more distinctly different materials with properties that are superior or intermediate to those of the individual constituents". Classification based on filler size Lutz and philips (1983) microfilled composites, macrofilled composites and hybrid composites. Based on viscosity, packable, flowable, and medium (Lahari et al., 2019). Composite resin materials is being used in dentistry more and more for several reasons desired performances, such as aesthetic appearance due to their mechanical properties and good physical. Availability of a variety of commercial products make composite resins appropriate for use in many clinical applications, including as core buildups, luting cements, restoration materials, and liner materials and many more (Alzraikat et al., 2018).

The principal composition of composite resins consists of a resin matrix as an organic component, fillers or filler particles as inorganic filler materials, and coupling agents that can combine the two components of organic and inorganic. The mechanical properties and aesthetic appearance of composite resins are influenced by their composition and microstructure (Alzraikat et al., 2018).

The importance of composite resin color matching in ensuring the aesthetic and natural properties of direct composite restorations as well as the macro- and micro-morphology of natural teeth is equally important. In particular, some specific morphological features of individual teeth - as well as the interaction of these features with all the teeth in the arch affect light reflection, proportional alignment of the entire smile and color perception. For this reason, an excellent understanding of these details and how to combine them into a composite restoration immediately after an anterior direct composite restoration is needed when contouring, finishing and polishing to produce the most lifelike restoration possible. The most lifelike and aesthetically pleasing restoration possible (Vargas and Margeas, 2021).

Restoration of class IV composite resin using the free-hand layering technique to restore fractured anterior tooth structure is made with additional mock-up assistance which can produce a palatal guide that is good at reconstructing dental restorations like natural teeth

and can produce good color gradation and transparency (Anastasia and Kesumaputri, 2017), (Gao et al., 2021). Creating aesthetically pleasing anterior restorations involves the dentist combining artistic skills with a basic knowledge of tooth morphology, along with the selection and use of appropriate composite resin materials. Based on fahl, it should be based on a good knowledge of the tooth shape, tooth color, and tooth function according to the clinical appearance of the natural teeth to select the appropriate composite resin (Romero et al., 2017). The purpose of this article is to know how to make restorations on anterior teeth using composite resin materials.

Case Report

A 20 years old male visited RSGM Soelastri complaining of a fractured tooth that interfered with his appearance. The tooth was fractured due to falling to the floor since 6 years ago. The patient had no history of systemic disease. The extraoral examination was normal, no abnormalities were detected. Intraoral examination detected a horizontal fracture reaching the dentin, without pulp exposure or root fracture, with sondation (-), palpation (-), percussion (-), vitality (+). The diagnosis in this case was that tooth 11 had a ellis class II fracture with a treatment plan, which was a class IV composite resin restoration because the two maxillary central incisors showed white color. The patient was requesting a highly aesthetic fracture restoration.



Figure 1. Clinical features before treatment.

Procedure

Before the treatment, the patient's informed consent is needed. The first step is to explain to the patient the purpose and procedure of the treatment.

The first appointment, an impression is made using alginate. After that, it was filled with type III gypsum, followed by wax up using inlay wax to shape the crown of the tooth to match its anatomical shape and make adjustments to the adjacent teeth. And then base and catalyst 1:1 are combined by hand until mixed, then molded with polyvinyl siloxine material on the working model. Next, the tooth that has been shaped is then molded using polyvinyl siloxine, the labial parts are cut so that only the palatal parts are taken as a guide to form the palatal wall.



Figure 2. (a) Result of polyvinyl siloxine molding; (b) Wax up with wax inlay

The second visit, before the treatment, isolated the work area. Then the preparation of make a bevel with an angle of 45 degrees using a flame bur (made a minimum width of 2 mm). Next, etching using 37% phosphoric acid, dentin 15 seconds and enamel 20 seconds, then rinse and dry until moist. Then the bonding applied for 10 seconds then waited for 10 seconds and light cured for 10 seconds.



Figure 3. Isolation of work area.



Figure 4. Color selection.



Figure 5. (a) Etsa Application (b) Bonding Application.

Composite resin application. Position the palatal guide on the palatal area, followed by the application of composite resin on the palatal wall first, and then light cure for 20 seconds. After the palatal wall is shaped, remove the palatal guide. Position the packable composite resin in the shade A2 enamel color using a plastic instrument to shape the proximal wall and then light cure for 20 seconds. Then the application of dentin-colored packable composite resin to fill the dentin, then on the labial part of the application of enamel-colored composite resin with a layering technique then each layer is light cured for 20 seconds until the appropriate dental anatomy is formed by following the contralateral teeth. Check occlusion and finishing to remove sharp corners and smooth the surface of the restoration area using a finishing bur and finishing strip for the proximal surface. Finally, polishing is done using a polishing disc.



Figure 6. (a) Composite Resin Application.

The third visit, a control was necessary for evaluation of the treatment results. The subjective examination, the patient wants to check the tooth that was filled 1 month ago. Extraoral objective examination no abnormalities, as well as intraoral examination no discoloration of restored teeth, percussion (-), palpation (-), vitality (+).



Figure 7. (a) Control one month post-treatment.

Discussion

Restoration with composite resin treatment in fracture of anterior teeth proposes the natural signification being a concept and proposes the natural of clinical anatomical appearance. To make a clinical anatomical appearance we must give a different layer in each tooth according to their shape. This shape will mimicking the translucency and the natural color of the teeth. The successful of the restoration treatment will be determined by how naturally the filling resembles the natural tooth. In the proses, to mimicking a natural teeth, it usually have a difficulties on making a layering composite resin in fractured anterior teeth. It because the layering in fractured anterior teeth will really depend due to the wide variety of chroma, translucency, available colors, and penetrability of composite resins. Therefore, it is necessary professional and detailed perception of the natural optical characteristics of teeth and knowledge of the optical behavior of the composite resin used to reproduce the restoration (Ruschel et al., 2018). Class IV composite restorations present a great challenge to dentists. The dentist who will perform the treatment must have experience and knowledge of the basic anatomical shape of the tooth to be restored in order to get better results (Vargas and Margeas, 2021). In Class IV restorations, it's been observed that each 1/3 of the tooth shows its chromatic expressive due to the varied thickness of enamel and dentin in its composition (Rauber et al., 2017). In addition, replacement of the proximal contour in restorations is essential for function and aesthetics (Karl et al., 2022).

Enamel transparency varies from tooth to tooth and from individual to individual. Natural teeth have properties of opalescence, fluorescence and translucency, all of which must be mimicked by restoration materials to achieve clinical success. The presence or absence of color, enamel thickness, degree of translucency and surface texture are important components in determining translucency. Structural characteristics of the correct tooth to reproduce in a simplified way, as presented in this case. Color and opacity varies which allows reproduction of the chromaticity and transparency/turbidity of enamel and dentin. The technique of intrinsic characterization of composite resin restorations by staining are routinely used in dental clinics. Some manufacturers offer stainings that allow individualized and customized individualized (Myakal et al., 2021). Composite layering is key to achieving an aesthetically successful restoration (Mittal et al., 2021).

Free-hand layering technique composite resin restorations often require working models or a mock-up that can be done in several visits. The difficulty with free-hand layering technique is the management of three-dimensional layering and anatomical shape (Rao et al., 2022). Composite resin restorations offer many advantages; in the event of damage, they can be repaired easily compared to porcelain veneers, which take longer to complete (Anastasia and Kesumaputri, 2017). Although there are many different treatment options for a fractured anterior tooth, an important factor to consideration is the degree of invasion, cost, and lifetime of the restoration. It is easy to suppose that incisors with extensive fractures require ceramic restorations (Romero et al., 2017).

After isolation of the rubber dam, dental floss is fixed to the tooth to be treated to push the rubber dam to the apical and exposed as much enamel as possible for the bonding strength of the restoration material (Romero et al., 2017). Composite resin is a technique-sensitive material and adequate isolation of the operative field is critical to the success and longevity of the restoration. In addition, the patient's oral hygiene is an important determining factor associated with the success and longevity of restorations.

In class IV case, a polyvinyl siloxine mold was used for the palatal guide as the base for the subsequent filling. Composite placement for contouring is done in three increments, of which the first and second increments create the mesial and distal line angles. In third addition fills the gaps between the line angles, grooves or according to the anatomical structure of the tooth (Mittal et al., 2021). Dentin color is acquired from the gingival third where the enamel is thinnest. Dentin color is used to replace dentin and composite color at the incisal according to the transparency of the adjacent incisors. The enamel color is obtained from the middle third where the enamel is thickest. The incisal region of the tooth is checked for transparency for color selection (Leman, 2018).

Composite resin can discolor during the polymerization process. Adequate polymerization is an important factors to obtain optimal physical appearance of the composite resin and of course it is related to better clinical performance (Of et al., 2018). It is well-known that the monomer to polymer conversion is around 75% within in the first 10 minutes after photoactivation and may increase after 24 hours. Therefore, discoloration of the composite occurred during curing and as a post- polymerization reaction because of monomer conversion and may be persisted over time due to water absorption in the restoration material. In terms of aesthetics, the assessment of color dimensions affects the natural appearance of teeth. It is important to underline that restorative mock- up should be performed to ensure better predictability of results, due to the discoloration of the composite resin during polymerization, as well as 24 and 48 hours after polymerization (Ruschel et al., 2018). Mock-up also gave time for the patient to report required changes after use. The free-hand layering restoration technique in extensive anterior tooth fractures is challenging for dentists as it requires attention to detail and artistic skills as well as understanding when to use a single color or a combination of multiple colors and opacities (Romero et al., 2017); (Anastasia and Kesumaputri, 2017).

In this study, the appearance of natural teeth was influenced by color dimensions consisting of saturation, luminosity, and translucency. The color match of class IV restorations is influenced by the thickness of the composite resin layer because composite resin materials are used to produce enamel that is more translucent than dentin composite. The difference in the light refractive index of natural enamel and the light refractive index of the restoration material makes the restoration grayish in color due to the thick translucent composite resin restoration on the facial surface. The composite resin coating performed in this study was based on the concept of natural stratification which proposes a combination of optical properties of different coatings to achieve the best aesthetic result. In this study, composite resin restorations were made with a minimum enamel composite thickness and artificial dentin thickness that could provide adequate opacity without losing the value of the restoration. In addition, the finishing and polishing procedures were performed 48 hours after restoration, when the delayed polishing time may increase the microhardness and roughness on the surface of the composite restorations as the healing rate continues after the initial polymerization. (Ruschel et al., 2018).

However, according to (Ruschel et al., 2018) this result may be due to the rehydration time of teeth 3-5 and the post polymerization

period of the composite. Excessively dehydrated teeth will have their color restored after a period of time ranging from one month up to 12 months due to the absorption of water in the mouth. So, after finishing a restorations of Class IV, the tooth will gradually return to its natural color with time. Thus, the tooth color will return to its original color. that different composite resins change color after photoactivation, 7-9 after water storage, after artificial aging and after thermocycling. These composite discolorations may be related to the color of the material used and are dependent on the brand of composite.

A follow-up of one month showed that the clinical picture of the restoration showed no discoloration and no fracture. The dentist's consideration in color selection, the technique used and the experience of the dentist to determine quality results that are satisfying for the patient.

Conclusion

The excellent clinical success and low success rate associated with the freehand composite resin resurfacing technique makes it a good choice for restoration of large class IV fractures. The freehand layering technique combined with easy mock-ups for highly aesthetic restorations make it an ideal and cost-effective option. One disadvantage is the experience and artistic skill required to achieve quality results. Although more elaborate composite layering techniques exist and may be used in complex aesthetic scenarios, the simplified one that simply combines two body shades and applies basic dental anatomy concepts. The use of the techniques presented here will result in a highly aesthetic resin composite restorations in a short in a short duration of time. The recent advances in composite materials allow us to reproduce natural anatomical form with function in a very conservative a very conservative way. When we apply techniques conservative approach, we actually provide the possibility of further aesthetic choices in the future. With advances in the improvement of the physical, chemical and mechanical properties of dental composites, aesthetic and durable restorations can be made durable restorations are possible.

Acknowledgement

This journal article is written by the author based on the research (CLASS IV COMPOSITE RESTORATION OF PERMANENT MAXILLARY CENTRAL INCISOR) conducted by the author. The contents of this paper are the sole responsibility of the author. The opinions expressed herein are those of the author. The author is thankful to the Faculty of Dentistry, University of Muhammadiyah Surakarta, and the Dental Professional Program of RSGM Soelastris, as well as all those who have helped in the preparation of this case report.

Reference

- Alzraikat, H., M. F. Burrow, G. A. Maghaireh, and N. A. Taha. 2018. "Nanofilled Resin Composite Properties and Clinical Performance: A Review." *Operative Dentistry* 43(4): E173–90.
- Anastasia, Danica, and Bebbi Arisya Kesumaputri. 2017. "Restorasi Resin Komposit Dengan Free-Hand Layering Technique" *Jurnal Kedokteran Gigi Universitas Padjadjaran* 29(3).
- Dewiyani, Sari. 2017. "Restorasi Gigi Anterior Menggunakan Teknik." (*Kajian Pustaka*) 13(2): 5–9. Farani, Wustha, and Wasi Nurunnisa. 2018. "Distribusi Frekuensi Fraktur Gigi Permanen di Rumah Sakit Gigi dan Mulut Universitas Muhammadiyah Yogyakarta." 7(1): 28–36.
- Gao, Yi, Jiyao Li, Bo Dong, and Min Zhang. 2021. "Direct Composite Resin Restoration of a Class IV Fracture by Using 3D Printing Technology: A Clinical Report." *Journal of Prosthetic Dentistry* 125(4): 555–59. <https://doi.org/10.1016/j.prosdent.2020.02.017>.
- Juneja, Preena, Sadanand Kulkarni, and Sapna Raje. 2018. "Prevalence of Traumatic Dental Injuries and Their Relation with Predisposing Factors among 8-15 Years Old School Children of Indore City, India." *Clujul Medical* 91(3): 328–35.
- Karl, Elisabeta, Geetha Duddanahalli Siddanna, and Andrea Mantesso. 2022. "Preclinical Assessment of Class IV Proximal Contacts Following Different Teaching Strategies." *European Journal of Dental Education* 26(2): 409–15.
- Lahari, K., Jaidka, S., Somani, R., Revelli, A., Kumar, D., & Jaidka, R. (2019). Composite Restorations. *International Journal of Advanced Research*, 7(10), 761–779. <https://doi.org/10.21474/ijar01/9888>.
- Leman, Michael Andreas. 2018. "Class IV Direct Composite Restoration: A Case Report." *Makassar Dental Journal* 1(5): 1–4.
- Marufu, Chamunorwa, Olivia A Osiro, and Fred O Otieno. 2022. "Effect of Finishing Protocols and Staining Solutions on Color Stability of Dental Resin Composites." (April 2021): 561–70.
- Mittal, Rishu et al. 2021. "Restorative Technique for Class IV Direct Composite Restoration." *IP Annals of Prosthodontics and Restorative Dentistry* 7(1): 59–63.
- Myakal, A. (2021). *Anterior Esthetic Restoration Using Direct Composite Resin*. 11, 1–5.
- Novianthi Sidiartha, I Gusti Ayu Fienna, and I Gede Marantika Yogananda Sutela. 2020. "Penatalaksanaan Restorasi Komposit Kelas Iv Dan Pasak Richmond Pasca Perawatan Saluran Akar." *Interdental Jurnal Kedokteran Gigi (IJKG)* 16(1): 8–11.
- Of, Assessment et al. 2018. "Restoration By Using Trans-Tooth Curing Technique." 64: 803–9.
- Rao, Ajay Singh, Shreya Bhor, Nimisha Shah, and Naveen Chhabra. 2022. "Comparative Evaluation of Aesthetic Outcome of Direct Polychromatic Composite Layering and the „Index Cut-Back Technique“ for Restoring Class IV Defects Using a Newly Patented Simulated 3D Printed Mould: An in Vitro Study." *Journal of Oral Biology and Craniofacial Research* 12(5): 552–56. <https://doi.org/10.1016/j.jobcr.2022.07.007>.
- Rauber, Gabrielle Branco, Jussara Karina Bernardon, Luiz Clovis Cardoso Vieira, and Luiz Narciso Baratieri. 2017. "Evaluation of a Technique for Color Correction in Restoring Anterior Teeth." *Journal of Esthetic and Restorative Dentistry* 29(5): 309–16.
- Romero, Mario F., Jamie Grant Austin, and Megan Todd. 2017. "Restoration of a Large Class IV Fracture Using Direct Composite Resin: A Clinical Report." *Journal of Prosthetic Dentistry* 118(4): 447–51. <http://dx.doi.org/10.1016/j.prosdent.2017.02.007>.
- Ruschel, V. C., M. V. Martins, J. K. Bernardon, and H. P. Maia. 2018. "Color Match between Composite Resin and Tooth Remnant in

- Class IV Restorations: A Case Series.” *Operative Dentistry* 43(5): 460–66.
- Sidiartha, IGA Fienna N, and Putu Wiswananta P. 2020. “Penatalaksanaan Fraktur Ellis Kelas Iii 11 Dengan Pulpektomi Dan Restorasi Mahkota Pasak.” *Interdental Jurnal Kedokteran Gigi (IJKG)* 16(2): 28–33.
- Soneta, Sanjana et al. 2021. “Aesthetic Rehabilitation of Ellis Class II Fracture Using the Template Technique: A Case Report.” *International Journal of Current Research and Review* 13(15): 158–60.
- Vargas, Marcos A., and Robert Margeas. 2021. “A Systematic Approach to Contouring and Polishing Anterior Resin Composite Restorations: A Checklist Manifesto.” *Journal of Esthetic and Restorative Dentistry* 33(1): 20–26.
- Widya Nugrohowati, Christina, Wignyo Hadriyanto, and Tunjung Nugraheni. 2020. “Direct Composite Resin Restoration of Anterior Maxillary Teeth and Esthetic Smile Design: A Case Report and Esthetic Smile Design: A Case Report.” *Journal of Dentistry Indonesia* 27(2): 103– 8.