

Direct Resin Composite Restoration in Anterior Tooth: 10 Years of Clinical Follow-Up

Restauración Directa en Resina Compuesta en Diente Anterior: 10 Años de Seguimiento Clínico

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ABSTRACT: The emergence and development of resin-based materials, such as resin composites and adhesive systems, have shifted the restorative treatment of anterior teeth with caries lesions and/or fractures. Thus, based on the disadvantages of indirect restorations, direct esthetic restorations are restorative options even for anterior teeth with extensive loss of hard tissues. This study aimed to describe and discuss the direct resin composite restoration performed to solve the esthetic and functional impairments of the upper anterior teeth with diastemas. The upper left central incisor received total crown preparation for indirect restoration. Clinical results after 10 years were recorded. Considering the clinical characteristics of dental restorations, it is possible to conclude that direct resin composite restorations reestablished the esthetic and functional properties satisfactorily, even in a tooth with extensive coronal destruction. The success of the restorative treatment was dependent on factors related to the materials' properties, oral habits of the patient, and mostly the clinical skills of the dental clinician.

KEY WORDS: composite resins. dental restoration, permanent. esthetics, dental. longevity.

INTRODUCTION

The emergence of resin composites (RC) and adhesive systems has significantly changed the restorative treatments. Since then, teeth with caries lesions and/or fractures can be restored by conservative, cost-effective, and repairable techniques, with fewer injuries to pulp tissues and in a short time (Vural *et al.*, 2016; Lempel *et al.*, 2017; Gresnigt *et al.*, 2021). Besides, the evolution in the composition of RC, particularly related to the decrease in filler size, has resulted in more resistant and durable materials with enhanced surface polishing (Ferracane, 2011).

To restore extensive cavities, indirect ceramic restorations can be chosen over RC restorations due to resistance to worn (Lawson & Burgess, 2014; Bolaca

& Erdogan, 2019), and better esthetic properties such as color stability, brightness, and surface smoothness (Lawson & Burgess, 2014; Korkut *et al.*, 2016). However, indirect restorations require tooth preparation, even if ultra-conservative, longer chair time, the need for provisional restorations, high cost for patients, and difficulty or impossibility of repair. Moreover, the friability of ceramics increases the risk of fracture during the treatment (Fischer & Marx, 2002; Mesquita *et al.*, 2021).

Regardless of the material and restorative technique, the clinical expertise of dental clinicians is crucial to achieving adequate esthetic, functional, and long-lasting outcomes (Felippe *et al.*, 2004). Thus, the

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success and survival of restorations are closely related to suitable planning of the case, technical knowledge regarding adhesion to dental tissues, and color and optical properties of the material (Nahsan *et al.*, 2012).

The great variety of restorative materials leads to divergences in clinical protocols among dental clinicians (DC). Although the materials' composition allowed the manufacturers to guide the clinical indications, their selection and clinical behavior depend on the clinical skills of DC (Demarco *et al.*, 2012, 2017; Laske *et al.*, 2019; AlQhtani, 2020), cavity extension (Demarco *et al.*, 2012; Borgia *et al.*, 2019; AlQhtani, 2020), clinical time (Pini *et al.*, 2012; Romero *et al.*, 2017; Yanikian *et al.*, 2019), esthetic demand (Demarco *et al.*, 2012, 2015, 2017), tooth position in the arch (Demarco *et al.*, 2012; Borgia *et al.*, 2019; Laske *et al.*, 2019), occlusal factors (Demarco *et al.*, 2017), oral hygiene habits (Demarco *et al.*, 2012; Borgia *et al.*, 2019; Laske *et al.*, 2019), risk of caries (Demarco *et al.*, 2012, 2017; Laske *et al.*, 2019) and socioeconomical factors (Demarco *et al.*, 2012, 2017). All these mentioned factors affect the longevity of restorations and must be taken into account during the treatment planning.

Clinical follow-up is indispensable to a long-lasting treatment. In this step, the DC can identify deleterious habits and changes in occlusal loads, and the need for oral hygiene instructions. Based on the diagnosis, minimally invasive procedures can be performed to increase the survival of the restoration. Thus, meticulous observation of the case may guide the DC regarding the periodicity of the follow-up based on the patient's needs, material properties, and the restorative technique used.

Considering the advantages and clinical versatility of RC, this study aimed to describe the direct RC restorations performed in anterior teeth to reestablish esthetic and functional requirements. Herein, the clinical outcomes after 10 years are shown to highlight the benefits and limitations of the materials.

CASE REPORT

A male patient, 26 years old, was referred to the Lacto sensu Post-Graduation Program of Restorative Dentistry from the State University of Londrina (UEL) to treat his upper anterior teeth. During the intraoral examination, diastemas between the upper incisors,

total crown restoration of acrylic resin in the upper left central incisor, and calculus in the cervical region of lower anterior teeth were observed (Fig. 1). The radiographical examination showed no alteration of the periapical tissues.



Fig. 1. Initial clinical condition.

The patient reported dental trauma, at age 10, which resulted in a crown fracture of the upper left central incisor. At that time, with the consent of his legal guardians, the DC performed a total crown preparation (Fig. 2) followed by an acrylic resin restoration. Since then, that restoration is repositioned with calcium hydroxide-based cement whenever necessary.



Fig. 2. Clinical aspect of the upper anterior region. Note the full crown tooth preparation in tooth 21 and the extensive loss of hard tissues.

Based on the referral, the esthetic requirement, and the extension of restoration in the upper left central incisor, the dental team proposed indirect restorations to close the diastemas and restore the upper left central incisor. However, due to the high cost and the need for tooth preparation, the patient requested a more conservative and cost-effective treatment option. Thus, direct RC restorations were proposed by the dental team. After discussion and

information regarding the limitations and drawbacks of the RC for extensive restorations, the patient gave formal consent and allowed the dental team to proceed with the case.

Initially, periodontal treatment and oral hygiene guidance were properly informed to the patient. After that, the acrylic resin restoration was removed to allow the restorative mock-up. Type and shade of RC were selected as follows: Amelogen Plus®, Ultradent Products Inc., UT, USA; shade A3 for the cervical third; shade A2 for the middle and incisal thirds; shade Gray to overlay the buccal and incisal surfaces. The amount of RC to close the diastemas was also evaluated in this step (Fig. 3). After the visualization and approval of the provisional outcome by the patient, the permanent direct RC restorations were performed.



Fig. 3. Restorative mock-up to evaluate the color and volume of RC to be used. No acid etching and adhesive application were performed.

During the restorative treatment, the upper right central incisor and the upper left central incisor were first restored. After local anesthesia (2 % mepivacaine with epinephrine vasoconstrictor 1:100,000), modified absolute isolation of the operatory field using rubber dam and cyanoacrylate (Super Bonder®, Henkel Ltda, SP, Brazil) was performed. A retraction knitted cord (Ultrapak®, Ultradent Products Inc., UT, USA) was inserted into the sulcus to control the humid environment of the cervical region (Fig. 4). 35 % phosphoric acid etching (Ultra-Etch®, Ultradent Products Inc., UT, USA) was performed in the enamel for 30 seconds. In the last 15 seconds, the etching was also performed in the dentin of the upper left central incisor. After water rinsing and air drying, an etch-and-rinse 2-step adhesive system was applied over all the etched areas (PQ1®, Ultradent Products Inc., UT, USA) and light-cured with a LED unit (Radii Plus, SDI®, Australia; irradiance of 1500 mW/cm²) for 20 seconds.



Fig. 4. Modified absolute isolation of the operatory field.

The RC increments were inserted with a spatula following the shades previously selected during the mock-up (Fig. 5). Each RC increment up to 2mm was light-cured for 40 seconds. After the end of the restorations of the upper right central incisor and the upper left central incisor, the lateral incisors were also restored with the same RC and following the protocol and parameters previously described.



Fig. 5. RC increment after insertion and light-curing in tooth 21.

Finishing was performed to remove cervical excess, enhance the anatomy, and avoid premature occlusal contacts. For this, diamond-coated tips (3195F and 3168F; KG Sorensen, SP, Brazil) and silicon-impregnated polishers and brushes were used (Jiffy® Polishers; Ultradent Products Inc., UT, USA). In the proximal surfaces, a scalpel blade (#12; Feather Safety Razor, Osaka, Japan) and abrasive strips (Epitex®, GC America Inc., Chicago, IL, USA) were used. For polishing, fine and superfine grit discs (Sof-Lex Pop-On®; 3M ESPE, St. Paul, MN, USA), silicon-impregnated polishers and brushes (Jiffy®; Ultradent Products, Inc., South Jordan, UT, USA) were used (Fig. 6). After 18 months, the first follow-up was recorded. At that time, the RC restorations were repolished following the same protocol (Fig. 7).



Fig. 6. Immediate clinical aspect after finishing and polishing of the RC restorations in teeth 12, 11, 21 and 22.



Fig. 7. Clinical follow-up after 18 months.



Fig. 8. Clinical follow-up after 10 years.

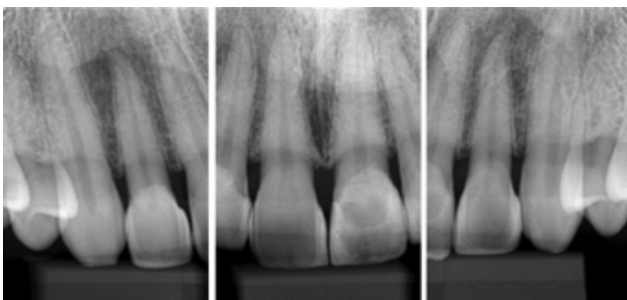


Fig. 9. Radiographical follow-up after 10 years.

After 10 years, clinical and radiographical follow-ups were recorded (Figs. 8 and 9). Due to the color alteration, two sessions of in-office dental bleaching using 35 % hydrogen peroxide (Whiteness HP Blue, FGM, Joinville, SC, Brazil) were performed. After that, the RC restorations were repolished (Fig. 10).



Fig. 10. Repolishing of RC restorations after in-office dental bleaching.

DISCUSSION

This case report describes the restorative treatment performed on a patient with multiple diastemas and a history of dental trauma and reports the long-term follow-up. After 10 years, the clinical outcomes highlight that a conservative approach, whenever possible, is crucial to maintain the esthetic and function of natural teeth. Moreover, the survival of restorations depends on the restorative technique, occlusal factors, oral habits, daily oral hygiene, and long-term evaluation of the case (Ferracane, 2011).

Although the patient was referred to dental care at age 26, the crown fracture in the middle third of the upper left central incisor, without pulp injury, occurred at age 16. The patient reported that his legal guardians decided to do not to perform the endodontic and prosthetic treatment of the fractured tooth. Thus, considering the amount of dental remnant and the esthetic demand, the DC performed a total crown tooth preparation to retain an indirect restoration. However, the indirect restoration was performed in acrylic resin and luted with calcium hydroxide-based cement. Throughout the years, that indirect restoration has been replaced or readapted due to poor marginal adaptation and/or color change.

Depending on the intensity, extension, and

consequences of the trauma, the treatment options for traumatized anterior teeth can vary from clinical follow-up, endodontic treatment, tooth fragment bonding, direct RC restorations, indirect restorations, tooth extraction, dental implants, and prosthetic rehabilitation (Brüllmann *et al.*, 2010). For crown fractures, the decision must be based on the radiographical outcomes and signs and symptoms that include: bone tissue integrity, tooth mobility, quality and quantity of the dental remnant, reported pain, soft and pulp tissue conditions (Zaleckiene *et al.*, 2014; Andreasen & Kahler, 2015).

Although conservative and fast, tooth fragment bonding is a conservative and fast approach that naturally reestablish the form, contour, and surface texture of a tooth without selecting material and shades by the DC (Farik *et al.*, 2002; Taguchi *et al.*, 2015; AlQhtani, 2020). However, the tooth fragment was not available for bonding, which excluded that treatment option.

For the esthetic and functional resolution of the case, a metal-free crown in the fractured of the upper left central incisor and indirect ceramic fragments to close the diastemas were considered. However, factors such as patient occlusion (Brambilla & Cavallè, 2007; Demarco *et al.*, 2017), amount of dental remnant in the upper left central incisor (Brambilla & Cavallè, 2007; Skupien *et al.*, 2016), possible need for endodontic treatment (Brambilla & Cavallè, 2007; Ayna *et al.*, 2010), high cost (Batalocco *et al.*, 2012; Skupien *et al.*, 2016; Romero *et al.*, 2017; Gresnigt *et al.*, 2021). The clinical time required for prosthetic design and manufacturing (Pini *et al.*, 2012; Skupien *et al.*, 2016; Romero *et al.*, 2017; Yanikian *et al.*, 2019), biomechanical properties of materials to ensure functional and long-term outcomes (Christensen, 2004) were presented, discussed and considered by dental team and patient. After that, the patient decided on direct RC restorations over indirect ceramic restorations. It is important to emphasize that direct RC restoration or ceramic fragments are the most conservative treatments of fractured anterior teeth compared to full crown preparations (Christensen, 2004; Gresnigt *et al.*, 2021).

Unlike indirect restorations, the longevity of direct RC restorations is dependent on the clinical skills of the CD, their esthetic perception of dental optical characteristics, and artistic ability (Kina *et al.*, 2010; Kubo *et al.*, 2011; Ruschel *et al.*, 2017), that are crucial attributes to restore the esthetics, anatomy, and

function. The extension of the restored area is also important since larger areas increased the risk of failure due to fracture and/or secondary caries (Da Rosa Rodolpho *et al.*, 2011; Demarco *et al.*, 2012; Nedeljkovic *et al.*, 2020).

To predict the final outcome and minimize possible misunderstandings regarding the shade and volume of restorative material, the RC increments were inserted directly onto the teeth to be restored and light-cured without previously acid etching and/or application of the adhesive system, under relative isolation of the operatory field, creating a “color map” (Terry, 2000; Furuse *et al.*, 2016). After the selection of the RC, the restorations were performed under modified absolute isolation of the operatory field to control the humidity and, consequently, increase the success rate of the treatment, since the contamination of mineralized tissues by saliva, after acid etching, hinders resin infiltration and monomers conversion, decreasing the micromechanical bond strength of the adhesive system (Nair *et al.*, 2017).

Our clinical outcomes after 10 years of follow-up are also dependent on the volume and depth of RC increment (Bouschlicher *et al.*, 2004); time and irradiance of the light-curing unit (Besegato *et al.*, 2019); size and shape of the filler particles (Heintze *et al.*, 2019); finishing and polishing technique (Delgado *et al.*, 2015; Pala *et al.*, 2016; Freitas *et al.*, 2020); the patient's eating habits and oral hygiene routine (Dietschi *et al.*, 2019; Mara da Silva *et al.*, 2019). Therefore, long-term survival is not only a matter of selection and properties of the restorative material.

Over time, failure occurrence of direct RC restorations related to the surface texture may be observed (Santos *et al.*, 2022). pH changes and moisture of the oral environment are challenging situations for RC (Söderholm *et al.*, 1984) resulting in degradation of the polymer matrix (Söderholm *et al.*, 1996). Consequently, changes in the RC surface texture contribute to increased surface wear, biofilm accumulation, and marginal staining (De Witte *et al.*, 2003). The age of the restorations interferes with their longevity since a decreased survival rate is observed after 10 years of placement (Da Rosa Rodolpho *et al.*, 2011). Thus, to minimize the adverse effects of time, oral conditions, behavior of resin-based materials, diet and patient's eating habits on the restorations performed, follow-up sessions were scheduled to evaluate and repolish the restorations over the 10 years (Sayan *et al.*, 2020; Valizadeh *et al.*, 2020).

In this case, after 10 years of RC placement, two in-office dental bleaching sessions were performed to solve the color mismatch between tooth and restorations. The RC restorations were considered clinically acceptable for the patient and dental team who performed them, based on: color, shape, and contour. However, repolishing of the restorations was performed to improve surface texture, smoothness, and gloss. Restoration repair preserves sound tooth structure, consumes less clinical time, is better tolerated by patients, has lower cost, and increases the longevity of restorations. Marginal adaptation failures, marginal staining, and secondary caries were not diagnosed, which confirms that the longevity of the restorations is related to the presence of enamel in the entire cavity margin and the quality of the restorative technique used.

An important factor for the survival of the restorations was that the clinical follow-up was performed by the same professionals who performed them, throughout all the years. It was reported that changing professionals have a significant and negative effect on the longevity of restorations (Kubo *et al.*, 2011).

CONCLUSION

After the decision-making and the 10-years long-term clinical outcomes, it can be concluded that direct RC restorations restored the esthetic and function adequately by a minimally invasive and cost-effective approach, even in a situation with extensive loss of tooth structure. The 10-years follow-up highlighted that the survival of restorations is closely related to the materials' properties, the patient's oral habits, and mainly the clinical skills of the dental clinician.

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RESUMEN: La aparición y el desarrollo de materiales con base de resina, como las resinas compuestas y los sistemas adhesivos, han cambiado el tratamiento restaurador de los dientes anteriores con lesiones de caries y/o fracturas. Por lo tanto, en base a las desventajas de las restauraciones indirectas, las restauraciones estéticas directas son opciones de restauración, incluso para los dientes anteriores con una gran pérdida de tejidos duros. Este estudio tuvo como objetivo describir y discutir la restauración directa con resina compuesta, realizada para solucionar las deficiencias estéticas y

funcionales de los dientes anteriores superiores con diastemas. El incisivo central superior izquierdo recibió preparación de corona total para restauración indirecta. Se registraron los resultados clínicos después de 10 años. Considerando las características clínicas de las restauraciones dentales, es posible concluir que las restauraciones directas en resina compuesta restablecieron las propiedades estéticas y funcionales satisfactoriamente, incluso en un diente con destrucción coronal extensa. El éxito del tratamiento restaurador dependió de factores relacionados con las propiedades de los materiales, los hábitos bucales del paciente y, sobre todo, las habilidades clínicas del odontólogo.

PALABRAS CLAVE: resinas compuestas. restauración dental permanente, permanente. estética dental, longevidad.

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