

D. Re, F. Cerutti, G. Augusti, D. Augusti

Department of Biomedical, Surgical and Dental Sciences,
University of Milan, Division of Oral Rehabilitation,
Istituto Stomatologico Italiano, Milan, Italy

e-mail: fc@francescacerutti.it

Post-traumatic rehabilitation of anterior teeth with laminates composite veneers in children. Report of two cases

ABSTRACT

Background When treating children, a conservative and minimally invasive approach is mandatory. In dental traumas with partial coronal destruction, veneers represent the fastest and most effective method to rehabilitate front teeth of a young patient, since these no- or minimal-preparation restorations were proved to have predictable results without reducing the enamel layer. Indirect additive anterior composite restorations, besides being quick and minimally invasive, have to be considered a good treatment option for rehabilitating children, because they are inexpensive and repairable over time. Current laboratory techniques, associated with a strict clinical protocol, satisfy patients' restorative and aesthetic needs in few appointments and in a short time.

Case report The cases reported describe the minimally invasive treatment of two lateral incisors with nano-hybrid resin composite veneers after traumatic events. The patient satisfaction and good integration of indirect restorations confirmed the success of this rehabilitation.

Keywords Aesthetics; Composite veneers; Crown Fracture; Dental Trauma; Indirect restorations.

Introduction

Dental trauma is one of the most serious and frequent oral problems in active children [Chen et al., 2014; Zaleckiene et al., 2014]. Treatment of traumatised

patients requires immediate initial emergency treatment, followed by the restoration of the damaged oral structures [Santos Filho et al., 2007 ; Re et al., 2014].

According to the literature, the most frequent traumatic dental injuries in children are enamel fracture, non-complicated enamel-dentin fracture, and luxation [Mangani et al., 2007; Gresnigt et al., 2012; Gresnigt et al., 2013a]. The most frequent injury in permanent dentition were enamel fracture [30.9%] and enamel-dentin fracture [Kosyfaki et al., 2010; Maneenut et al., 2011]. Enamel-dentine fractures without involvement of the pulp range between 20.2 and 50.5% [Magne and Magne, 2006; Mangani et al., 2007; Malik and Tabiat-Pour, 2010; Alghazzawi et al., 2012; Gresnigt et al., 2012; Gresnigt et al., 2013a]; in these cases, the most common treatment was restoration [Sari et al., 2014].

Aesthetic rehabilitation of crown fractures of front maxillary teeth is one of the greatest challenges to the dentist [Re et al., 2014]. Reattachment of a fractured fragment to the remaining tooth can provide better and long-lasting aesthetics, improved function, a positive psychological response and is a faster and less-complicated procedure [Ninawe et al., 2013]. Nevertheless, when the fragment is missing or it does not adequately fit, the best option is a fast, painless and stress-free restoration.

Indirect additive veneering was introduced in the 1980s as an alternative to full-coverage crowns. The concept of no- or minimal-preparation [Magne et al., 2013] has followed the development of appropriate enamel bonding procedures. The color and integrity of dental tissue substrates to which veneers will be bonded are important for clinical success [Azer et al., 2011]; using additional veneers with a thickness between 0.3 mm and 0.5 mm, 95% to 100% of enamel volume remains after preparation and no dentin is exposed [LeSage, 2013]. A number of clinical studies have concluded that bonded laminate veneer restorations delivered good results over a period of 10 years and more [Layton and Walton, 2007; Layton et al., 2012; Layton and Walton, 2012]. The majority of the failures were observed in the form of fracture or marginal defects of the restoration [Peumans et al., 2004]. Pure adhesive failures are rarely seen when enamel is the substrate with shear bond strength values exceeding the cohesive strength of enamel itself [Marshall et al., 2010; Oztürk et al., 2013]. Restoration of missing dental tissue with resin composites is quick, minimally invasive, and inexpensive and the resulting restorations are easy to repair, if necessary [Mangani et al., 2007]: for these reasons, an indirect composite veneer seems to be a good treatment option for traumatised anterior teeth in children.

The present case report describes the treatment of two crown fractures in the anterior dentition with thin composite laminate veneers to restore aesthetics and function.

Case reports

Case 1

Diagnosis and treatment planning

A 9-year-old male patient underwent a dental injury while playing outdoors; clinical examination revealed a non-complicated coronal fracture of upper right lateral incisor, with no pulp exposure and no tooth mobility (Fig. 1). During the first appointment a radiological and photographic documentation was collected (Fig. 2, 3).

Dental preparation

The least invasive preparation with maximal preservation of enamel was performed. Interproximal surface refinement was performed by fine/superfine strips of the same system (Sof-Lex, 3M ESPE, St. Paul, MN, USA). Medium grit (100 µm) and fine grain (30 µm) tapered diamond burs (N. 868.314.016 and N. 8868.314.016, Kit 4388, Komet Dental, Milan, Italy) were used to smooth the labial surfaces.

All the tooth surfaces were finished using stone burs (based on a micrograined aluminum oxide grit; Dura-white stones, Shofu Dental GmbH, Ratingen, Germany) and polishing disks (Sof-Lex ExtraThin (XT) disks, number 2382SF and number 2382F, 3M ESPE) to promote maximum adaptation OF impression material and adhesive cementation.

Chairside Impression

Following the preparation, a high quality polyether precision material was used (Impregum Penta Duosoft, 3M ESPE) to take a one-step, double mix final impression; a light body (Duosoft L, 3M ESPE) was applied at the gingival margin and gently blown over the preparations. A full metallic tray was filled with heavy body impression material (Duosoft H, 3M ESPE), inserted in the oral cavity, and allowed to set according to the manufacturer's instructions and then removed.

An impression was taken in order to record the lower arch, to give the technician enough information about the occlusal relationships of the arches.

Laboratory Fabrication of Veneers

A working model of the upper arch was obtained from the definitive elastomeric impression. The dental technician prepared a wax-up on the working cast, mimicking the shape of the upper left lateral incisor.

A microhybrid with nanoparticles resin material (Miris 2, Coltène Whaledent) was positioned at the inner surface of a silicon index and composite restorations of upper right lateral incisor was made.

No dye spacer was used on dental cast so as to achieve optimal adaptation of the restoration with minimal thickness of resin composite cement. Microtextures detailing was accomplished with finishing diamond burs. The composite restoration was finally refined: the adjustment of rough contours and polishing with stones



FIG. 1
Intraoral
anterior
view of
tooth 1.2
before
treatment.



FIG. 2
Intraoral
lateral
view of
the tooth
1.2 before
treatment.



FIG. 3
Intraoral
occlusal
view of
the tooth
1.2 before
treatment.



FIG. 4
Intraoral
anterior
view of
the tooth
1.2 after
treatment.



FIG. 5
Intraoral
lateral
view of
the tooth
1.2 after
treatment.



FIG. 6
Intraoral
occlusal
view of
the tooth
1.2 after
treatment.

(Dura-green stones, Shofu Dental GmbH, Ratingen, Germany) and disks (Sof-Lex, 3M ESPE St. Paul, MN, USA) allowed the fabrication of life-like veneers. The restoration was seated on the working model and sent to the clinician.

Luting

After three days the patient returned for placement of the restoration and a try-in was carried out. The tooth was cleaned with pumice and dried and a transparent try-in paste was applied on the intaglio surface (Variolink try-in paste, Ivoclar). The marginal adaptation was checked with a probe using dental loupes (Orasoptic HiRes 3.3x magnification). An adhesive cementation was performed: the dental enamel surface and the inner veneer surfaces were treated before luting. The first one was etched with 38% phosphoric acid for 30 seconds, washed for 60 seconds, and gently dried; then a universal dental adhesive (Scotchbond Universal, 3M ESPE) was applied using a microbrush. The inner surface of the restoration was sandblasted with 50 micron Al₂O₃ for 10 seconds at 2.8 bar pressure and cleaned, then a silane coupling agent (ESPE-Sil, 3M ESPE, St. Paul, MN, USA) was used to facilitate the creation of high bond strength to the cement. A coat of adhesive was applied to the inner surface of the restoration and left uncured.

A thin layer of preheated resin composite material was used as a luting agent (Miris 2, Coltène Whaledent, Altstätten, Switzerland) and directly applied to the inner surface of the veneer.

The restoration was slowly seated on the tooth; pressure was applied in order to facilitate adaptation and flow of the luting agent. While handling the veneer in place, excess resin cement was carefully removed using a sickleshaped scaler (Novatech cement remover, Hu-Friedy Co., Chicago, USA). Glycerine gel was applied at the margins to prevent an oxygen inhibition layer at the interface; subsequently a prolonged light curing was performed at facial, incisal, and palatal sides for 90 seconds each (Bluephase LED curing light, Ivoclar).

Following light-curing, residual remnants of cement were removed with the help of a N. 12 surgical blade and a dental probe; flossing was performed at the proximal areas to confirm patency at the contact points. Margins were finished and polished with diamond burs, rubber points, and diamond polishing paste.

Aesthetic Result

Intraoral and occlusal views of the restored tooth at the follow-up, one week after the cementation procedure, are shown in Figures 4-6. The nice integration of the indirect restoration and the absence of pain/sensitivity and discoloration confirmed the success of this rehabilitation.

Case 2

Diagnosis and treatment planning

A 10-year-old male patient had an injury while he was in school; clinical examination revealed a non-complicated coronal fracture of upper left lateral incisor, with no pulp exposure and no tooth mobility (Fig. 7).

During the first appointment a radiological and photographic documentation was collected

Dental Preparation and chairside impression

The minimally invasive preparation was carried out as previously described, smoothing the fracture margins by fine grain diamond burs, stone burs and polishing discs.

Following the preparation, a high quality polyether one-step, double mix impression of the upper arch was taken. A one-step impression of the lower arch was recorded to give the technician enough information about the occlusion.

Luting

Two days after the preparation and the impression, the patient returned for the placement of the veneer and a try-in was carried out. The tooth was cleaned with pumice and dried and a transparent try-in paste was applied on the intaglio surface (Variolink try-in paste, Ivoclar). The marginal adaptation was checked with a probe using dental loupes (Orasoptic HiRes 3.3x magnification).

Adhesive luting was performed as previously described, by means of a preheated composite material directly applied to the inner surface of the veneer. Following light-curing, residual remnants of cement were removed with the help of a N. 12 surgical blade and a dental probe; flossing was performed at the proximal areas to confirm patency at the contact points. Margins were finished and polished with diamond burs, rubber points, and diamond polishing paste.



FIG. 7
Intraoral anterior view of tooth 2.2 before treatment.



FIG. 8
Intraoral occlusal view of the tooth 2.2 one week after treatment.



FIG. 9
Intraoral lateral view of the tooth 2.2 at the 1-week recall.

Aesthetic Result

Intraoral and dentolabial views of the result at the follow-up, one week after the cementation procedure, are shown in Figures 8 and 9; the final result satisfied both the aesthetic and functional requirements of the patient.

Discussion

Guidelines have been developed for management of numerous medical and dental conditions. Dental trauma guidelines, first developed and published in 2001 and updated twice since then, have been accepted as reliable recommendations for the urgent care of traumatic dental injuries; the most recent trauma guidelines were completed by the International Association of Dental Traumatology and published in 2012. The application of these guidelines is to provide both patients and practitioners with the best available information about management of such injuries [Bakland, 2013]. A recent study confirmed that, in children with traumas, in primary teeth, avulsion was the most common type of dental injury; on the other hand, enamel fractures were the most common type of dental injury observed in permanent teeth. In the primary dentition, a careful examination associated with no restorative dental treatment was performed for limited fractures; whereas, common treatment choices for permanent teeth with similar kind of traumas involved a restorative procedure [Sari et al., 2014].

In paediatric patients, anterior teeth with fractures that extend subgingivally require a complex treatment plan that addresses biologic, aesthetic, and functional factors, such as mastication and speech [Ulusoy et al., 2012]. As regards uncomplicated crown fractures, it is stated that, if the fracture of the permanent tooth is contained within the enamel and dentin surfaces without exposure of the pulp tissues, then the tooth can be restored with tooth-colored dental material, or if the tooth fragment is available, it can be rebonded to the tooth. The tooth should be monitored for signs of pulpal necrosis [Keels, 2014] and followed up in order to manage the aesthetic requirements of the patient over time [Marongiu and Cochran, 2014].

The treatment of traumatised teeth can be performed both with direct and indirect techniques [Mangani et al., 2007; Horvath and Schulz, 2012]; the latter procedures might require more than one appointment but are preferred because the chair time is extremely reduced and the aesthetic result is guaranteed [Mangani et al., 2007]. Different materials could be used to fabricate veneers: feldspathic ceramics [Peumans et al., 2004], hybrid composites [Mangani et al., 2007], or high-density ceramics (alumina, glass-infiltrated zirconia, zirconia) [Alghazzawi et al., 2012]. From a biological point of view, margins of indirect veneers are most frequently placed at the juxta or supragingival area; it

has been documented that an extrasulcular location is able to provide adequate soft-tissue health [Kosyfaki et al., 2010]. Indirect rehabilitation is suggested and employed in severe dental injuries [Giachetti and Pace, 2008], but also in cases of teeth with amelogenesis imperfecta or hypoplasia [Khatri and Nandlal, 2010], because indirect veneers last much longer than the direct veneers. Therefore, indirectly fabricated veneers are more advantageous than directly fabricated veneers in many cases, especially since preparation has become minimally invasive. Veneers were also considered as a therapeutic alternative even in the restoration of decayed primary anterior teeth [Lee, 2002; Oliveira et al., 2006]. While treating primary teeth with indirect restorations could seem extreme, in the literature, other cases, in which permanent traumatised teeth were treated with veneers, are reported [Belcheva, 2001].

In this case report, a composite material was selected due to its ease of use and inexpensive cost; a nano-hybrid composite with nanoparticles was preferred to porcelain due to the ease of handling in the try-in and luting procedures. Fractures of resin composite materials could also be simply repaired with direct chairside techniques [Maneenut et al., 2011]. A preheated light-cure composite has been suggested for cementation and selected in our rehabilitation due to the ultra-thin thickness of laminates and for its low polymerisation shrinkage and coefficient of thermal expansion compared to currently available resin luting agents [Acquaviva et al., 2009; Rickman et al., 2011]. Among the disadvantages of resin materials, some concerns have been raised regarding cytotoxicity [Nocca et al., 2012]; however, this might not represent a problem when no direct contact with living cells (i.e., pulp tissue) exists. While the scientific literature is more extensive for ceramic laminates, a recently published clinical trial (with a 3-year follow-up) has reported no significant difference in the survival rate of composite (87%) and ceramic (100%) veneers; on the other hand, some surface quality changes were more frequently observed for the resin materials (i.e., minor voids and defects and slight staining at the margins) [Gresnigt et al., 2013b]. In addition, the survival rate and clinical performance of composite or ceramic laminate veneers were not significantly influenced when bonded onto teeth with preexisting composite restorations (when no caries or infiltration is present) or onto intact teeth [Gresnigt et al., 2012; Gresnigt et al., 2013a]. As a final recommendation, as with many other types of indirect restorations, the dentist should plan a careful follow-up programme to monitor the tooth vitality and give patients appropriate instructions for maintenance and preservation of the restoration.

Conclusion

In the two cases reported treatments with resin

composite veneers followed the principles of enamel preservation to achieve functional and aesthetic rehabilitation of the upper incisors and seemed to be the most cost-effective treatment for the two traumatised paediatric patients.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

- › Acquaviva PA, Cerutti F, Adami G, Gagliani M, Ferrari M, Gherlone E, Cerutti, A. Degree of conversion of three composite materials employed in the adhesive cementation of indirect restorations: a micro-Raman analysis. *J Dent* 2009; 37: 610-5.
- › Alghazzawi TF, Lemons J, Liu P-R, Essig ME, Janowski GM. The failure load of CAD/CAM generated zirconia and glass-ceramic laminate veneers with different preparation designs. *J Prosthet Dent* 2012; 108: 386-93.
- › Azer SS, Rosenstiel SF, Seghi RR, Johnston WM. Effect of substrate shades on the color of ceramic laminate veneers. *J Prosthet Dent* 2011; 106, 179-83.
- › Bakland LK. Dental trauma guidelines. *J Endod* 2013; 39: S6-8.
- › Belcheva AB. Esthetic restoration of traumatized permanent teeth in children using composite vestibular veneers (preliminary communication). *Folia Med (Plovdiv)* 2001; 43: 9-11.
- › Chen Z, Si Y, Gong Y, Wang JG, Liu JX, He Y, He WP, Nan Z, Zhang Y. Traumatic dental injuries among 8- to 12-year-old schoolchildren in Pinggu District, Beijing, China, during 2012. *Dent Traumatol* 2014; 30: 385-90.
- › Giachetti L, Pace R. Rehabilitation of severely injured anterior teeth in a young patient using ceramic and FRC: a clinical report. *Dent Traumatol* 2008; 24: 560-4.
- › Gresnigt MMM, Kalk W, Ozcan M. Randomized controlled split-mouth clinical trial of direct laminate veneers with two micro-hybrid resin composites. *J Dent* 2012; 40: 766-75.
- › Gresnigt MMM, Kalk W, Ozcan M. Clinical longevity of ceramic laminate veneers bonded to teeth with and without existing composite restorations up to 40 months. *Clin Oral Investig* 2013a; 17: 823-32.
- › Gresnigt MMM, Kalk W, Ozcan M. Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up. *J Adhes Dent* 2013b; 15: 181-90.
- › Horvath S, Schulz C-P. Minimally invasive restoration of a maxillary central incisor with a partial veneer. *Eur J Esthet Dent* 2012; 7: 6-16.
- › Keels MA. Management of dental trauma in a primary care setting. *Pediatrics* 2014; 133.
- › Khatri A, Nandlal B. An indirect veneer technique for simple and esthetic treatment of anterior hypoplastic teeth. *Contemp Clin Dent* 2010; 1: 288-90.
- › Kosyfaki P, Del Pilar Pinilla Mart'In M, Strub JR. Relationship between crowns and the periodontium: a literature update. *Quintessence Int* 2010; 41: 109-26.
- › Layton DM, Clarke M, Walton TR. A systematic review and meta-analysis of the survival of feldspathic porcelain veneers over 5 and 10 years. *Int J Prosthodont* 2012; 25: 590-603.
- › Layton DM, Walton TR. An up to 16-year prospective study of 304 porcelain veneers. *Int J Prosthodont* 2007; 20: 389-96.
- › Layton DM, Walton TR. The up to 21-year clinical outcome and survival of feldspathic porcelain veneers: accounting for clustering. *Int J Prosthodont* 2012; 25: 604-12.
- › Lee JK. Restoration of primary anterior teeth: review of the literature. *Pediatr Dent* 2002; 24: 506-10.
- › Lesage B. Establishing a classification system and criteria for veneer preparations. *Compend Contin Educ Dent* 2013; 34: 104-17.
- › Magne P, Hanna J, Magne M. The case for moderate, "guided prep" indirect porcelain veneers in the anterior dentition. The pendulum of porcelain veneer preparations: from almost no-prep to over-prep to no-prep. *Eur J Esthet Dent* 2013; 8: 376-88.
- › Magne P, Magne M. Use of additive waxup and direct intraoral mock-up for enamel preservation with porcelain laminate veneers. *Eur J Esthet Dent* 2006; 1: 10-9.
- › Malik K, Tabiat-Pour S. The use of a diagnostic wax set-up in aesthetic cases involving crown lengthening—a case report. *Dent Update* 2010; 37: 303-7.
- › Maneenut C, Sakoolnamarka R, Tyas MJ. The repair potential of resin composite materials. *Dent Mater* 2011; 27: e20-7.
- › Mangani F, Cerutti A, Putignano A, Bollero R, Madini L. Clinical approach to anterior adhesive restorations using resin composite veneers. *Eur J Esthet Dent* 2007; 2: 188-209.
- › Marongiu N, Cochran T. Conservative cosmetic dentistry post-trauma. *Gen Dent* 2014; 62: 26-31.
- › Marshall SJ, Bayne SC, Baier R, Tomsia AP, Marshall GW. A review of adhesion science. *Dent Mater* 2010; 26: e11-6.
- › Ninawe N, Doifode D, Khandelwal V, Nayak P. Fragment reattachment of fractured anterior teeth in a young patient with a 1.5-year follow-up. *BMJ Case Rep* 2013. DOI: 10.1136/bcr-2013-009399
- › Nocca G, D' Antò V, Riviaccio V, Schweikl H, Amato M, Rengo S, Lupi A, Spagnuolo G. Effects of ethanol and dimethyl sulfoxide on solubility and cytotoxicity of the resin monomer triethylene glycol dimethacrylate. *J Biomed Mater Res B Appl Biomater* 2012; 100: 1500-6.
- › Oliveira LB, Tamay TK, Oliveira MD., Rodrigues CM, Wanderley MT. Human enamel veneer restoration: an alternative technique to restore anterior primary teeth. *J Clin Pediatr Dent* 2006; 30: 277-9.
- › Öztürk E, Bolay S, Hickel R, Ilie N. Shear bond strength of porcelain laminate veneers to enamel, dentine and enamel-dentine complex bonded with different adhesive luting systems. *J Dent* 2013; 41: 97-105.
- › Peumans M, De Munck J, Fieuws S, Lambrechts P, Vanherle G, Van Meerbeek B. A prospective ten-year clinical trial of porcelain veneers. *J Adhes Dent* 2004; 6: 65-76.
- › Re D, Augusti G, Amato M, Riva G, Augusti D. Esthetic rehabilitation of anterior teeth with laminates composite veneers. *Case Rep Dent* 2014; DOI: 10.1155/2014/849273.
- › Re D, Augusti D, Paglia G, Augusti G, Cotti E. Treatment of traumatic dental injuries: evaluation of knowledge among Italian dentists. *Eur J Paediatr Dent* 2014; 15: 23-8.
- › Rickman LJ, Padipatvuthikul P, Chee B. Clinical applications of preheated hybrid resin composite. *Br Dent J* 2011; 211: 63-7.
- › Santos Filho PC, Quagliatto PS, Simamoto PCJ, Soares CJ. Dental trauma: restorative procedures using composite resin and mouthguards for prevention. *J Contemp Dent Pract* 2007; 8: 89-95.
- › Sari ME, Ozmen B, Koyuturk AE, Tokay U, Kasap P, Guler D. A retrospective evaluation of traumatic dental injury in children who applied to the dental hospital, Turkey. *Niger J Clin Pract* 2014; 17: 644-8.
- › Ulusoy AT, Tunc ES, Cil F, Isci D, Lutfioglu M. Multidisciplinary treatment of a subgingivally fractured tooth with indirect composite restoration: a case report. *J Dent Child* 2012; 79: 79-83.
- › Zaleckiene V, Peciuliene V, Brukiene V, Drukteinis S. Traumatic dental injuries; etiology, prevalence and possible outcomes. *Stomatologija* 2014; 16: 7-14.