SUMMARY

Crown fractures are common among schoolchildren. They create serious functional, aesthetic and psychological problems. The clinicians must propose high aesthetics in the front part and the choice of exact treatment plan. Repeated reconstructions are needed in many cases because of compromised results as time passed by. Achievement of promising restoration that preserves its aesthetics and strength is the greatest desire for both children and their parents. The aim of this study was to assess the effectiveness of composite resin veneers used for restoration of fractured permanent teeth in children.

30 fractured incisors of children aged 12-17 were investigated. Restorations were made using direct-indirect composite resin veneers, a method modified by us. Control exams were made after 6 and 12 months. Data were put in a statistic card. Quality assessment of the composite resin veneers was made according to the Robertson et al scale of the Californian Dental Association.

The results showed that there were no statistically significant differences between the investigated indices: colour, marginal stains, anatomic form, surface structure and marginal adaptation of composite resin veneers, studied in dynamics. Therefore, the proposed method is effective for restoring fractured permanent incisors in children.

Keywords: Fractured Teeth; Composite Resin Veneers; Children

Introduction

Tooth fractures are the most common injury among traumas of permanent dentition. The clinician should maintain tooth’s healing and restore the aesthetics and function. It makes the dentist’s job difficult and responsible. The improvement of contemporary restorative materials gives alternatives for successful restorations of fractured permanent teeth in children.

In the last 20 years dentists have manufactured veneers to the teeth using different techniques for correction of aesthetic problems. The veneers are divided in 3 groups according to the materials and techniques applied:

1. direct composite veneers;
2. direct-indirect composite veneers and preformed acryl laminates;
3. indirect (laboratory made) acryl, composite, porcelain and glass-ceramic veneers.

Introduction of enamel etching technique and elaboration of hybrid and micro-filled composite resin materials gives opportunity for more conservative restoration of fractured teeth in connection with application of minimal tooth preparation1. In 1975 the first porcelain veneers have been placed after testament of the connection with tooth structures15. Development of the adhesive systems leads to creation of more stable linkage between bonding surfaces and tooth structures3-4.
Indications for utilization of veneers are pretty large. There are evidences for their usage in tooth fractures, treatment of diastema, teeth with malformations, change of position, discolorations\(^3\). Veneers are indicated in restoration of fractured permanent teeth in children for strength improvement and achievement of satisfied aesthetics\(^11\). There isn’t enough prospective clinical studied showing the usage of composite resin veneers in children. The aim of this study was to assess the effectiveness of composite resin veneers used for restoration of fractured permanent teeth in children. The null hypothesis was that composite resin veneers can be used successfully in children as a conservative method of reconstruction.

### Material and Methods

30 fractured incisors of children aged 12-17 were investigated. Most of the teeth were with complicated fractures that needed endodontic treatment; others had a vast destruction of enamel and dentin without pulp involvement. The clinical protocol followed the guidelines given by the IADT for treatment of tooth traumas in permanent dentition. After that the restoration was made by direct-indirect composite resin veneers, a technique modified by us. The fractured incisors were build-up with composite resin to their normal weight. Tooth preparation included reduction of tooth structures according to the technique described by Larson\(^10\). Reduction of vestibular surface was 0.5-0.7 mm. When the colour was changed dramatically we used intracoronal bleaching with Opalescence Quick (Ultradent, USA) according to the manufacturer’s instructions. Proximal finishing lines did not extend beyond the contact point in the incisal third of the tooth. It means that the contact point with the adjacent teeth was preserved. The incisal edge was reduced for 2 mm and the preparation was finished linguually with enamel bevel. Bevel’s width depended on the incisal guidance.

The veneers were made by direct-indirect method from composite resin “Herculite XRV” (Kerr, USA)\(^1\). This method utilized vestibular celluloid matrix, prepared from the vestibular part of celluloid crown, matching the anatomic form of the fractured tooth. Enamel and dentin layers were put in the matrix according to the tooth’s colour. The matrix with the resin layers was returned to the tooth that was only cleaned, isolated and dried. Then the veneer was preliminary cured. The final curing was made in the polymerizing light box (Fig. 1) for 7 min, after which the veneer was adjusted to the tooth’s surface and the adjacent teeth.

The composite resin veneer was tried to the tooth surface with try-in paste. After etching and bonding, the composite resin veneer was fixed with dual cement (Nexus, Kerr, USA). The excess of resin round the periphery of the veneer was removed at that stage with metal instrument. The suggested cure time was about 60 sec. The achievement of the aesthetics was done by finishing and polishing. To eliminate any occlusal interference, a system of carbide and diamond burs, polishing disks (Soflex discs) and polishing pastes was used (Kerr, USA).

Control follow-ups were made after 6 and 12 months. Data were put in a statistic card. Quality assessment of the composite resin veneers was made according to the modified Robertson at al scale of the Californian Dental Association\(^14\). Colour, marginal stains, anatomic form, surface structure and marginal adaptation have been assessed with the codes A, B, C, D. Relative parts of restorations that have maximal assessment (A) were calculated. The results at the 6th and 12th month periods were compared to that made right after the restoration.

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**Figure 1.** Light box TransluxCL (Heraeus Kulzer, Germany)

**Figure 2.** Dynamic changes in the indices in children with fractured permanent teeth receiving composite resin veneers restorations
Results

In this study, the restoration of fractured permanent teeth in children with composite resin veneers was applied mainly in bigger lost of hard tissues, in considerable aesthetic problems, when other conservative methods failed. Manufacture of composite resin veneers in fractured teeth demands, firstly, the re-creation of the fractured part. Management of this stage defines to a great extent the final treatment success. When teeth were endodontically treated, good aesthetics could hardly be achieved, especially in cases with permanent discoloration of hard tissues.

Clinical assessment of restoration by composite resin veneers was excellent at the end of the treatment for the indices “marginal adaptation” and “surface structure” (assessment “A” (95-100%). The index “colour” in some cases did not manage the exact colour of the neighbouring teeth. This could be due to the discoloration of some endodontically treated teeth.

On the 6th month follow-up, quality of the indices assessed was “very good” (assessment “A” between 91% and 95%). Lower were values of indices “colour” and “anatomic form” (90.00±5.48%), but they were also in the borders of the optimal assessment. At the 12th month follow-up, quality of all the investigated indices was assessed above 80% from the maximum. Relatively lower was the level of the index “marginal adaptation” (Fig. 2).

The inter groups comparison did not find any statistically significant difference between the indices’ values, studied in dynamics - p=0.05.

Discussion

In the search for an optimal treatment to restore the aesthetically prominent maxillary anterior dentition, new materials were continually introduced. The attention of patients has shifted from function to aesthetics, biocompatibility of the materials utilized, and conservative preparation of teeth to be restored. To fulfil patient expectations, an advanced treatment modality has recently been developed.

The advantages in restoring fractured teeth with veneers were discussed in many clinical and experimental studies. Restorations with veneers were proposed as a reliable and effective procedure when restoring large parts of the coronal volume and length in the anterior dentition12. It was pointed out that the economical and non-invasive treatment of crown-fractured teeth is among the considerable advantages of veneering teeth12. The traditional treatment approaches involved the removal of large amounts of sound tooth substance (with adverse effects on the pulp, gingiva and crown biomechanics, as well as serious financial consequences). Instead, the usage of adhesive technology provided maximum preservation of tissues and limited costs. In our study we used minimal tooth preparation in order to achieve good aesthetics and preserve tooth structures. It was in accordance to the contemporary instructions given from P. Heasman8 for the usage of composite resin veneers in children. The author advised composite resin veneers in children for 2 reasons: the large size of the young pulp horns and chamber and the immature gingival control.

Direct and indirect composite laminate veneers showed comparable mean fracture strengths7. Microfilled composite resins were most often used for fabrication of direct veneers. Some of these materials had insufficient resistance to masticatory pressure and had different module of elasticity13. That led to covering hybrid composite resin with microfilled in order to reduce the risk of fractures9. In our study we used hybrid composite for its strength and aesthetic qualities. For improving quality parameters of composite resin veneers, they were put under additional influence of high temperature and light. Thus all free monomers were assimilated and the polymerization shrinkage minimized10. The modification of our method included extra curing in a special light box in order to improve their physical properties. Direct/ indirect composite resin veneers utilize the advantages of both techniques (direct and indirect) in reconstruction of restorations.

Direct resin bonding represents a conservative means of providing aesthetic restoration of the anterior dentition. Such technique enables chair side control of colour, morphology, and ultimately, aesthetic results. For optimal integration, the clinician must thoroughly understand the capabilities of resin materials and their behaviour when layered in direct resin build-ups. Fahl demonstrates how to enhance the appearance of the anterior dentition in an advanced clinical technique, achieved via tooth whitening and a combination of Class IV restoration and a direct resin veneer6.

Patients have many restorative options for changing the appearance of their teeth. The most conservative restorative treatments for changing the appearance of teeth include tooth bleaching, direct composite resin veneers, and porcelain veneers. Patients seeking aesthetic treatment should undergo a comprehensive clinical examination that includes an aesthetic evaluation. When selecting a conservative treatment modality for children, the use of minimally invasive or no-preparation veneers should be considered16.

Composite resin veneers made in our direct-indirect method allowed to be extra polymerized using additional heat and light to achieve: higher level of polymerization - up to 95-98% more compared to 55-60% for the direct methods; higher mechanical strength for the better adhesion and composite resin polymerization; better colour stability for the lower number of free monomers in the composite resin. Restoration of fractured permanent teeth using composite resin veneers is a technique
available to most dental practitioners\textsuperscript{2,6,7,16}. Since it is a restoration that can easily be repaired, it is especially suitable for fractured teeth in children. This conservative treatment uses minimally invasive tooth reduction and there is no reason for a child to wait until late adolescence for treatment. Aesthetic problems in childhood and adolescence can have a significant effect on psychosocial development and interaction with peers. Abnormalities of shape, size, colour and structure of the whole or part of the anterior dentition can lead to such problems\textsuperscript{2}. That was the reason for us to restore children’s teeth in their early adolescence. We found composite resin veneers durable enough to last through adolescence. Our results confirm the null hypothesis that composite resin veneers can be used successfully in children as a conservative method for reconstruction.

**Conclusions**

4. When restoring fractured permanent incisors by utilizing composite resin veneers, the most significant were changes of the index “marginal adaptation” on the 12\textsuperscript{th} month follow-up.
5. The proposed method is effective for restoring fractured permanent incisors in children. There are no statistically significant differences between the indices’ values, studied in dynamics - p>0.05.

**References**


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