

RECONSTRUCTION OF FRACTURED PERMANENT INCISORS IN SCHOOLCHILDREN USING COMPOSITE RESIN BUILD-UP (REVIEW)

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SUMMARY:

Crown fractures represent the largest part of traumatic injuries to the permanent teeth. They are relatively common event among schoolchildren. They create serious functional, esthetic and psychological problems for both children and their parents. The front position of fractured teeth gives precondition for easy notices which make esthetics the most important factor. The clinicians should deal well with all characteristics of color, shape and adhesive protocol. Difficulties may occur because of the small patient's age, the right choice of treatment plan and its fulfillment.

In this review are collected data for the method composite resin build-up when restoring fractured incisors. A different improvements and objections have been discussed in order to achieve succession in the right therapeutic approach.

Key words: composite resin, crown fractures, permanent teeth

INTRODUCTION

Crown fractures of permanent teeth are common pathology in school ages as nearly half of the children have at least one traumatized tooth before leave school (2). One of the serious challenges for the clinician is to restore esthetics and function of the fractured tooth. This includes reconstruction of its shape and size; achievement of identical color with definite opacity and translucency; creation of harmony in esthetics – reproduction of fluorescence and opalescence as characteristics of color. (24).

These objectives are attainable and with predictable results after development of contemporary adhesives, composite resin materials in combination of appropriate technique (22, 23, 24, 26).

Aim of this review article is to discuss all the aspects of reconstructing fractured permanent incisors at schoolchildren using composite resin build-up.

MATERIALS AND TECHNIQUES

Many clinicians reconstruct fractured teeth by using composite resin for it is the most popular method in practice but when treating a child there are some factors to be considered. It is important to note that pulp chamber in children has bigger volume (1) and in a presence of fracture is exposed a great number of open dentin tubules to the oral environment. This creates possibility for pulp damages (13). As it is well known children fracture most often their teeth between ages 8 and 11 (19). It is important to consider that at small children eruption has not fully finished, as well as the completely teeth position (1). Another specific feature is the fact that after the trauma teeth should be treated minimal invasively with lower number manipulations to prevent pulpal or periodontal damage (19).

In a study by Alonso and Balboa the authors propose preformed acetate crowns, used for a matrix, and composite resin to restore a vast fracture in the front part of 10 years old child. After 8 years of follow-up the restoration remained esthetic and functional (1). Achievement of optimal esthetics in this case is more difficult but the method can be successfully applied in incisors with large fractures (11). Another author uses this method but only temporary for retention of Ca hydroxide- cement on fractured upper central incisor of 7-years old girl. In this case the acetate crown is fixed with glass-ionomer cement (13).

In fractured children's teeth covering the exposed dentin with Ca hydroxide- cement is recommended in extensive opening of dentin surface and increased sensitivity of thermal stimulants (13, 19). In the next appointment the teeth are reconstructed permanently with composite resin (15). The authors propose manufacture of a silicone impression from restored with wax plaster models. This silicone matrix helps to restore a palatal wall on which to stratify enamel and dental layers. The matrix diminishes operative time, gives opportunity for modeling the occlusal anatomy upon stable palatal base (15).

Adhesive preparation of the enamel surface is used for retention of restorations by composite resin build up. Tan and Tjan find significant influence of tooth preparation upon the strength of composite resin restorations of

fractured teeth. A 2 mm bevel provides significantly higher strength compared with 1 mm bevel or without preparation (20).

In some cases it is necessary to put dentin pits for strengthening the mechanical retention. Usage of para pulp pins when reconstructing fractured children's teeth should be managed with care for the widely exposed dental pulp. Their exact placement requires preciseness and sometimes leads to compromise in the esthetics (13). Some authors pay attention of the extra tension that pins make in the hard dental tissues. As alternative they apply different adhesive systems that provide enough strength and excellent esthetics (9).

Zalkind and Heling (25) describe in 1992 a method for consecutive reconstruction of widely destructed incisors. This technique includes alternation of dentin layers that restore the missing part of the dentine and enamel layers representing the enamel surface of the tooth. This concept is grounded in the contemporary stratification technique for adhesive esthetic restoration. Bichacho (3) recommends direct intraoral application of stratification technique with which achieves optical effects of intact teeth. Vanini in one of his studies uses 5 type layers (opacer, dentin, based enamels, saturated enamels and dyes), that reproduces the five parameters of natural color –saturation, brightness, intensity, opalescence and characteristics (24).

According to Terry (22) the clinician possesses knowledge to create more natural restorations when understands the whole tooth's morphology and takes the intact tooth as starting point for morphologic thinking. Combination of contemporary composite resin with optimized particles and such morphological thinking allow building of restorations in harmony with the whole dentition. Terry demonstrates incremental composite resin restoration of fractured teeth.

De Araujo et al. stand that contemporary adhesive restorations give the opportunity to the clinician to offer minimal invasive, functional and esthetic treatment of patients with fractured incisor teeth. That is way the usage of this method of restoring fractured teeth in children is successful because of the spare approach to the hard tissues (7).

Fahl takes into consideration the qualities of the composite resin materials. He points the basic challenge when restoring fractured teeth – to choose resin that has adequate strength but also to ensure optical features of intact teeth in order to create functionally strong and esthetically pleasant restorations. To achieve absolute control upon the process of crown restoration of great importance are resin's features such as high plasticity, wide range of shades, different opacities and translucencies, as well as good polishing. (8)

Hybrid composite resins have been defined as a "golden standard" for restorations in the front region (23).

The hybrid composite resin exhibit superior tensile strength and improved abrasion resistance as well as reduced polymerization shrinkage. They exhibit greater fracture resistance as a result of inclusion of heavy inorganic fillers (22).

Optimization of composite resin particles' size to a great extent solves the problem for esthetic restoration. The recent introduction of an optimized particle composite with an average „true size" of 0,4 μ m (with 90 % of the particles below 0,8 μ m) represents development for the ideal composite material (22). The developed microhybrid composites and nanocomposites provide natural color shades in combination with mechanical strength and good polishing (10,22). Davis appreciates highly and recommends restoration of fractured teeth with nanocomposites (6).

COLOR DETERMINATION

Tooth color depends on dentin (21). The organic part of dentin absorbs light with different wave length. Size and orientation of dentin tubules also influence absorption (12). This defines the difference in color shades between young patients and adults.

In spite polychromatic characteristics of natural tooth in many cases it is possible to use one composite color for the whole restoration. Stratification of composite layers is the key for esthetically successful restoration. Esthetic dentistry requires detailed observation, patience and pedantic application of the clinical protocol. The color variations that usually can not be observed from a distance are one of the greatest desires of children and their parents. This becomes main objective and for the dentist when restoring precisely fractured incisor teeth (8).

The clinician should determine the basic color (hue), intensity of color or its saturation (chrome) and brightness (value) of the restoring composite material according to the natural tooth's color. The shades of microfilled and microhybrid composites may change after polymerization. While microfilled become lighter (have higher value and lower chrome), microhybrid resins become darker (lower value and higher chrome). In most cases patients are not satisfied with monochromatic restorations. That is the reason De Araujo et al. (7) to propose for every clinician initially to work out clinical protocol and chromatic card of the restored tooth and to pay attention on the three-dimensional aspects. The main colors (A, B, C, D), intensities (A1, A2, A3) and different opacities and translucencies of the natural tooth should be registered on this card. The incisal third is of great importance, concerning size localization color and shape of translucent region as well as the presence of opalescent halo in the incisal edge. In children is specific presence of mamelons that should be placed to resemble natural teeth. (22)

Thickness, hue, chroma and value of the enamel layers influence the final dentin color that gives the clinician

possibility to put and polymerized enamel layers over dentin composite layers. Enamel translucence tends to increase with time. That should be considered when choosing color of the enamel. Thickness of the enamel layer should be approximately 0,2 to 1,0 mm. Restoration of fractured incisor needs technique of incremental layering with adding of opacer and dyes to mask the dark color of oral cavity(16).

In spite the excellent esthetic results that provides, restoration of crown fractures with composite resin material after exact color determination can be very labor and time consuming. That's the reason some authors to present different clinical protocols which will save time and assist the clinicians (4,6,7,8,9,11,17,22).

PROGNOSES

Prognosis of class IV-composite restorations is controversial question, referring stability and esthetics. Robertson et al. (14) concluded that for a period of 15 years 19% of the restorations of fractured children's teeth have been rebuild 10 times, another 25% have been assessed as unsatisfactory at the final exam. Authors point the most probable reasons for failure of these restorations and refer them to the used adhesive system. Some of them are bond insufficiency, leading to fracture of the resin, lack of marginal adaptation, marginal stain.

In a long lasting clinical trial Spinaz (18) investigate 130 children aged 8 to 18 and follows up quality of restored with composite resin fractured incisors. The author finds need of intervention at 3-years old restorations – from

polishing to repair. In the period 3-5 years all the restorations need to be repaired. The results show that restorations have been changed 3 or 4 times before the significant decrease of tooth's adhesive recourses. According to the author composite resin restorations can not be long lasting. He considers after finishing of child's development that prosthetic restorations are obligatory therapeutic alternative.

Any failure of composite restorations can lead to fulfillment of less conservative method like veneer preparation or prosthetic restoration. The last generations adhesive systems and the optimized composite resin materials increase duration of the restorations. That is way the technique for composite resin restoration of fractured incisors is accessible and realizable in schoolchildren (4,5).

CONCLUSION

Elaboration of the dentin adhesive systems, enamel acid etching and development of contemporary composite resin materials give choice at reconstructing fractured permanent teeth at children. Application of incremental technique by enamel and dentin layering makes restoration sufficiently saturated in the dentin and at the same time translucent in the incisal edge. This method re-creates natural shape, structure and color of the fractured teeth. The advantage of composite resin build up of fractured children's teeth is preservation of hard tissues. Achievement of predictable and satisfactory results when restoring fractured teeth of schoolchildren is carried out by creation and following of systematic protocol.

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