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Biological Restorations as a Treatment Option for Primary Molars with Extensive Coronal Destruction - Report of Two Cases

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This article reports the cases of two young children aged 4 and 5 years, in whom biological restorations using tooth fragments were placed in primary molars with severely damaged crowns due to extensive carious lesions. After radiographic and clinical evaluation, tooth fragments obtained from extracted teeth in stock were autoclaved, adjusted to the prepared cavity and bonded to the remaining tooth structure with either adhesive system (Case 1) or dual-cure resin-based cement (Case 2) over a calcium hydroxide layer and a glass ionomer cement base. Occlusal adjustment was performed and topical sodium fluoride was applied to tooth surface. Periodical clinical and radiographic controls were carried out and the restored teeth were followed up for 4 and 3 years, respectively, until exfoliation. In these two reports, the technical aspects are described and the benefits and disadvantages of biological restorations as an alternative treatment for rehabilitation of severely destroyed primary molars are discussed.

Key Words: biological restoration, primary teeth, fragment bonding, tooth fragment.

INTRODUCTION

Dental caries is the most prevalent disease in humans and manifests with an extremely high index in several countries, especially during early childhood. Primary molars with extensive carious lesions are routinely observed in clinical practice and should be properly restored to reestablish their anatomy and hence their masticatory, phonetic, esthetic and space-maintainer functions in the dental arches. In an attempt to widen, as biologically and conservatively as possible, the treatment options to rehabilitate severely destroyed tooth crowns, several authors have suggested the use of tooth structure as a restorative material (1-7).

The expression "biological restoration" was coined by Santos and Bianchi (8), in 1991. This technique consists of bonding sterile dental fragments to teeth with large coronal destruction. Cavity preparation should be non-retentive and the fragment is retained with adhesive materials. Fragments obtained either from the patient or from a tooth bank may be used as a safe and reliable alternative to restore dental anatomy and function with excellent biomechanical properties (2,9).

The first paper reporting the use of fragments of extracted teeth as dental restorative materials was published in 1964 by Chosak and Eidelman (10). Thereafter, several other reports have demonstrated the advantages of this technique, such as favorable esthetics, resulting from enamel's natural surface smoothness, anatomic contouring and color match, functional and masticatory

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effectiveness, preservation of sound tooth structure, prevention of physiological wear, and no need of complex material resources (3,5,6,9,10).

This article describes two cases in which biological restorations using tooth fragments were placed in primary molars with severely damaged crowns due to extensive carious lesions.

CASE REPORT

Case 1

A 5-year-old patient was admitted to the Pediatric Dentistry Clinic of the School of Dentistry of Ribeirão Preto, University of São Paulo, Brazil, with an extensive carious lesion in the primary mandibular left first molar underneath a glass ionomer provisional restoration (Fig. 1A). After clinical and radiographic examinations, local anesthesia was given and a rubber dam was placed for isolation of the operative field. Cavity preparation was limited to removal of the glass ionomer restoration and carious tissue and flattening of cavity walls and margins. Retentive areas were eliminated. As the tooth had vital pulp, the cavity floor was protected with a calcium hydroxide cement layer (Dycal; Dentsply Ind. e Com. Ltda., Petrópolis, RJ, Brazil) and a glass ionomer cement base was built (Vitrebond, 3M/ESPE, St. Paul, MN, USA).

The rubber dam was removed and an impression of the mandibular arch was taken using irreversible hydrocolloid material (Jeltrate Plus; Dentsply Ind. e Com. Ltda.). A stone cast was obtained (Fig. 1B) and the mesiodistal, cervico-occlusal and buccolingual dimensions of the tooth were measured using a compass, in order to select an extracted tooth from stock, whose coronal dimensions best fitted the prepared tooth. Color matching was also taken into account.

A tooth was selected, decoronated and the coronal fragment was adjusted with diamond points at high-speed under air/water spray coolant until it fitted the cavity. Articulating paper was interposed between the fragment and the cavity in the stone cast to demarcate the areas that needed further adjustments. The prepared fragment was autoclaved at 120°C for 20 min.

In a second clinical appointment, a rubber dam was placed and, after prophylaxis, the adaptation of the fragment to the tooth was checked (Fig. 1C). Both the cavity and the fragment were etched with a 37% phosphoric acid gel (Acid Gel; Dentalville, Joinville, SC, Brazil) during 30 s, rinsed and dried. A polyester matrix strip was placed and maintained with a wedge and Scotchbond multipurpose adhesive system (3M/ESPE) was applied to the cavity and fragment, according to the manufacturer's instructions. The fragment was adapted to the tooth and each surface was light-cured for 60 s (Fig. 1D). Small imperfections were corrected with light-curing composite resin (Z-250, 3M/ESPE) and the occlusion was checked with articulating paper. Fluoride gel (Sultan-Topex; DFL, Rio de Janeiro, RJ, Brazil) was topically applied to tooth surfaces.

Case 2

A child aged 4 years and 10 months was brought to our Pediatric Dentistry Clinic with a severely damaged primary mandibular left second molar due to an extensive carious lesion (Fig. 2A). Local anesthetic was administered and the tooth was isolated with a rubber dam. During caries excavation, it was noted that all cavity walls were involved, which did not allow placing an amalgam restoration. A biological restoration was proposed. The cavity floor was protected with a calcium hydroxide cement layer (Dycal, Dentsply Ind. Com. Ltda.) and a glass ionomer cement base (Vitrebond, 3M/ESPE) was built. In this case, however, retention grooves were prepared because the amount of remaining tooth structure was not sufficient for adhesion. Impressions were taken from the maxillary and mandibular arches and an interocclusal wax record was obtained. The casts were mounted in a non-adjustable articulator. The steps for selection of a tooth compatible with the remaining tooth structure, cutting and adaptation of the fragment to the stone cast (Figs. 2B and 2C) were the same as described for Case 1.

At the second visit, prophylaxis was done, fragment adaptation was tested and occlusion was checked. After rubber dam placement, the fragment was bonded with a dual-cure resin-based cement (Enforce, Dentsply Ind. Com. Ltda.), according to the manufacturer's instructions. The material was light-cured on buccal and lingual surfaces for 40 s (Fig. 2D). The fragment/tooth interface was sealed with composite resin (Z-250, 3M/ESPE), light-cured for 40 s (Fig. 2E). The restoration was finished and a resin-based sealant was applied to fragment pits and fissures (Fluroshield, Dentsply). Occlusion was adjusted and topical fluoride

(Sultan-Topex, DFL) was applied (Fig. 2F).

In both cases described in this paper, the steps, benefits and disadvantages of the technique were fully explained to the parents and a signed, written informed consent was obtained. The parents were instructed to bring the children periodically for clinical and radiographic controls. The restored teeth were followed up for 4 and 3 years, respectively, until exfoliation. Post-treatment course was uneventful.

DISCUSSION

The use of bonded tooth fragments as biological restorations constitutes a viable restorative alternative for teeth with extensive coronal destruction. The technique is simple, allows the preservation of sound tooth structure and provides excellent esthetics compared to composite resins and stainless steel crowns, especially regarding translucency. In addition, it allows maintenance of pulp vitality (11) and has low cost (12). An advantage of using tooth fragments as restorative materials is that the enamel has physiologic wear and offers superficial smoothness and cervical adaptation compatible with those of surrounding teeth (6,9,13,14). Biological restorations not only mimic the missing part of the oral structures, but are also biofunctional (15).

Clinical chairtime for fragment bonding procedures is relatively short, which is very interesting when treating pediatric patients (2,3,5,6,15). However, as any indirect restorations, biological restorations require a laboratorial phase that may become a critical step if not properly handled. Hence, in spite of being simple, the technique requires professional expertise to adequately prepare and adapt the natural crowns to the cavity.

Disadvantages of the biological restoration technique include the difficulty in obtaining teeth with the required coronal dimensions and characteristics, problems inherent to indirect restorations and matching fragment color with tooth remnant color. Also, having fragments from other people's teeth in their mouth is

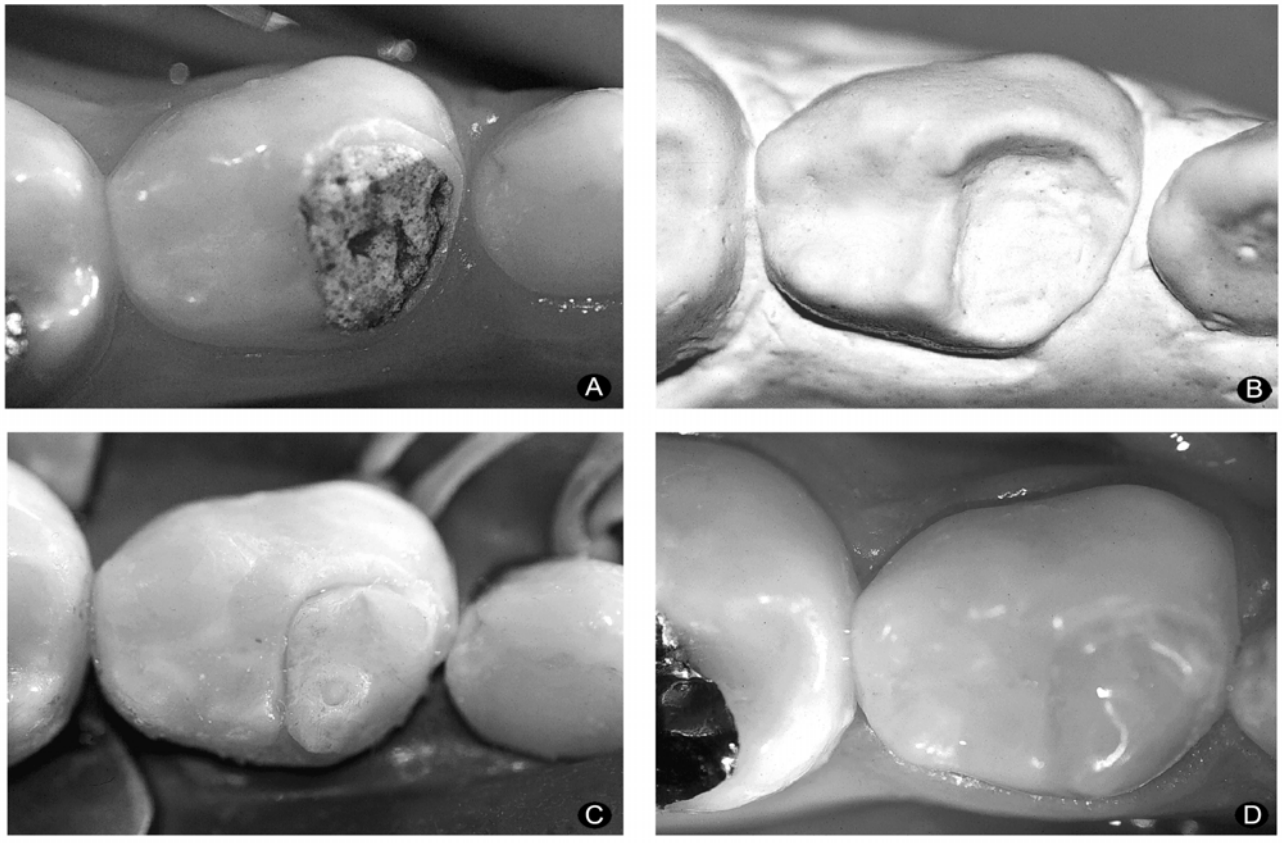

Figure 1. A= Initial clinical aspect; B= Cast model; C= Fragment bonded to the tooth; D= Final aspect of the restoration.

not a pleasant idea for some patients and many of them refuse to receive this treatment (2). However, all these factors are not contraindications of the technique.

It is important that the parents are informed that the tooth fragments used for biological restoration are previously submitted to a rigorous sterilization process

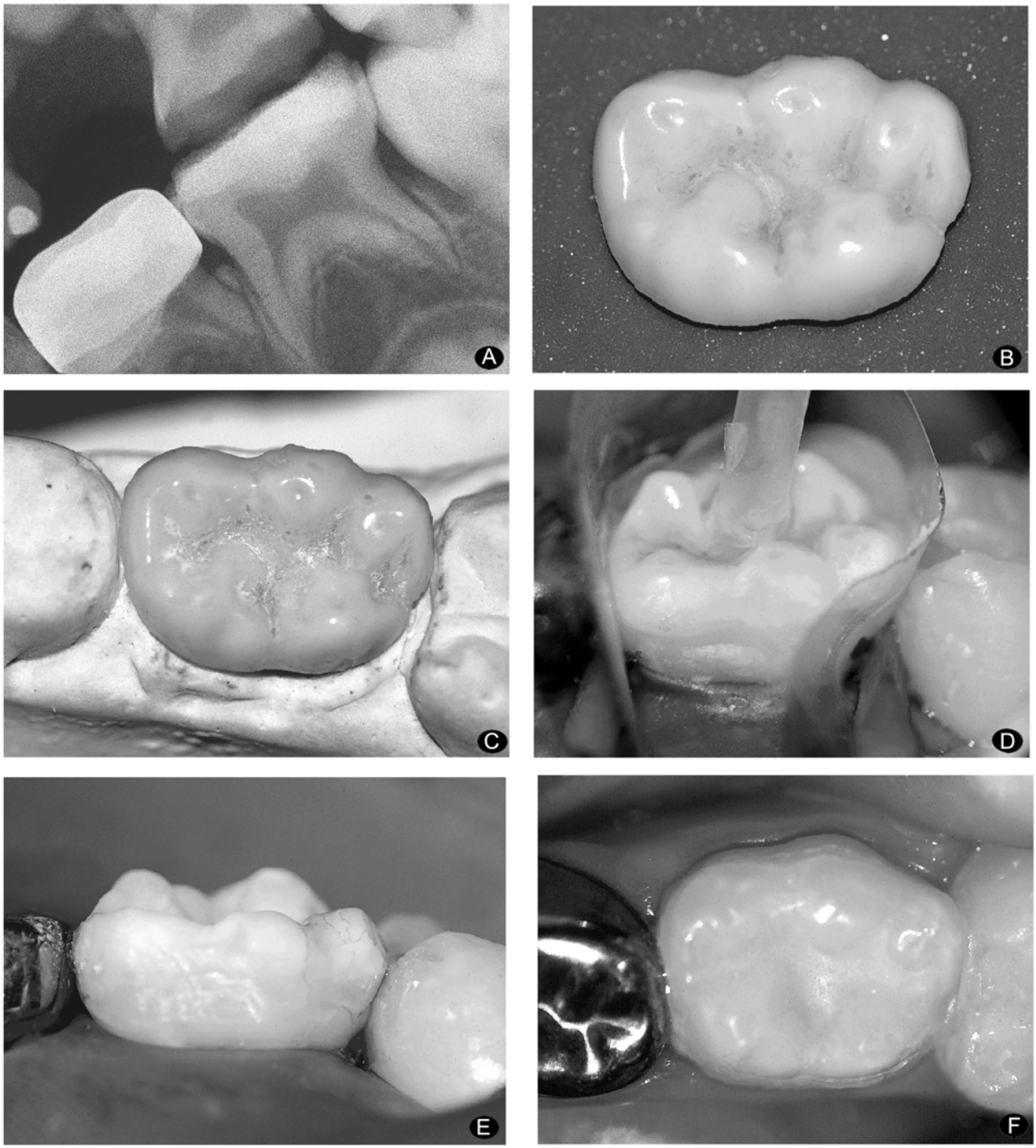

Figure 2. A= Initial interproximal radiograph; B= Tooth fragment; C= Fragment adapted to cast model; D= Fragment bonded to the tooth; E= Correction with composite resin; F= Final aspect after sealant application.

that completely eliminates any risk of contamination or disease transmission to the child receiving the fragment. Presently, secure methods of sterilization and storage are available to ensure the safety of teeth or tooth fragments coming from tooth banks (2,16,17).

Several materials have been used for bonding dental fragments to cavities, e.g., adhesive systems, composite resins, glass ionomer cements and dual-cure resin cements (2). In the cases hereby presented, the choice for each bonding material was based on fragment dimensions and bonding agent layer thickness. In Case 1, the fragment had small dimensions and hence the use of an adhesive system was the best choice because a thin bonding agent layer was required not to interfere with fragment adaptation. Scotchbond multipurpose adhesive system produces a good homogenous hybrid layer and similar characteristics, involving resin penetration of peritubular and intertubular dentin matrix (18). In Case 2, a larger and thicker fragment was used and there was concern that optimal light-curing would not be achieved at the cavity gingival margin. Thus, a dual-cure resin-based cement was used to enhance polymerization at this region in addition to filling any possible gaps existing at tooth/fragment interface (7). An important point is that, regardless of the material used for fragment bonding, rubber dam placement is essential for a high-quality restoration. Periodical clinical-radiographic follow-up until primary tooth exfoliation is mandatory for long-term success.

Based on the positive results in the literature (2,3,5-7,9) and on our own clinical experience, it may be concluded that the biological restoration technique using tooth fragments has a practical clinical applicability and is a viable, cost-effective restorative procedure for primary teeth with severely damaged crowns.

RESUMO

Este artigo descreve dois casos clínicos de reconstrução de molares decíduos com extensa destruição coronária por meio de restaurações biológicas, em crianças de 4 e 5 anos. Após avaliação clínica e radiográfica, os fragmentos dentais heterógenos foram submetidos à colagem ao remanescente dental preparado usando sistema adesivo (Caso 1) ou cimento resinoso de presa dual (Caso 2) sobre uma camada de hidróxido de cálcio e uma base de ionômero de vidro. Foi realizado ajuste oclusal e aplicação tópica de flúor sobre a superfície dentária. Controles clínico e radiográfico foram realizados periodicamente e os dentes restaurados foram acompanhados por 4 e 3 anos respectivamente, até a exfoliação. Por meio destes dois relatos, os autores discutem os aspectos técnicos, além das vantagens e desvantagens das restaurações biológicas como tratamento alternativo para restauração de molares decíduos.

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