

Esthetic Recovery of Smile Using Composite Resin and “Biological Posts” and Crowns

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The recovery of teeth that have been extensively destroyed by dental caries can be achieved through direct and indirect restorative procedures. This paper presents a case of the esthetic and functional recovery of permanent maxillary incisors with extensive dental caries in an adolescent patient through the use of a composite resin and “biological posts and crowns”. A case report was drafted to describe the direct restoration of central maxillary incisors using composite resin and endodontic treatment of the lateral maxillary incisors, the construction of dentinal posts, the adaptation and cementing of the posts to the root canals, preparation and molding of crown portions, model construction, the choice of extracted teeth and the making and cementing of “biological crowns”. The use of a composite resin and the cementing of “biological posts and crowns” reestablish dental esthetics and function. Biological restorations maintain all the characteristics of natural teeth and have a significant psychosocial impact on the patient’s quality of life. However, it should be stressed that this technique was only indicated in the present case after the determination of a significant improvement in oral hygiene.

Keywords: Dental caries, Adolescent, Crowns.

INTRODUCTION

Dental caries is considered the most prevalent oral disease worldwide and a large portion of affected teeth remain untreated.¹ Etiological factors include a cariogenic diet, lack of adequate oral hygiene and the presence of cariogenic microorganisms; moreover, dental caries are often associated with socioeconomic factors.^{1,2,3} Treatment involves the restoration of affected teeth and the suspension of harmful habits.^{1,2}

In recent decades, dentistry has achieved considerable scientific and technological advances in restorative and adhesive materials.

However, no restorative materials to date have surpassed the properties found in the dental structure itself.^{4,6} Thus, “biological restorations” (restorations using fragments of extracted teeth) represent a benchmark in the art of restoring anterior teeth, as such restorations allow the use of tooth fragments from the patient himself/herself or from duly donated sterilized extracted teeth obtained from a Tooth Bank.^{4,7} Biological restorations allow the reestablishment of the original characteristics of natural teeth, such as greater surface smoothness, maintenance of physiological wear and tear, low cost and positive psychological outcome.^{5,6,8,9}

Dentinal posts or “biological posts” (intra-radicular posts cut from the dentin of duly donated sterilized extracted natural teeth) offer the following advantages: absence of stress to the dentin; preservation of the inner dentinal walls of the root canal; complete biocompatibility with and adaptation to the configuration of the root; greater tooth strength and greater post retention in comparison to pre-manufactured posts; resilience comparable to the tooth itself; excellent adhesion to the dental structure and composite resin; and low cost.^{4,5}

This paper presents a case of the esthetic and functional recovery of permanent maxillary incisors with extensive dental caries in an adolescent patient through the use of a composite resin and the cementing of “biological posts and crowns”.

CASE REPORT

A 13-year-old female with a low socioeconomic status (monthly household income less than US\$325) was treated at the Dentistry Clinic of the Federal University of the Vales do Jequitinhonha e Mucuri in the city of Diamantina, Brazil, for the extensive decay of the permanent maxillary incisors due to dental caries (Figures 1A,

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Figure 1. [A] Initial smile; [B] Initial radiograph of permanent maxillary incisors; [C] Initial clinical aspect.

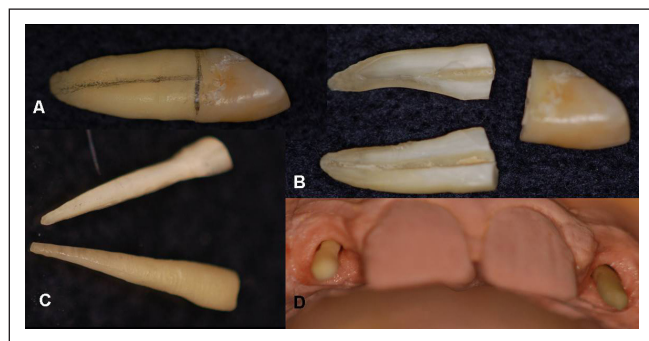


Figure 3. [A] Tooth selected for cutting out of posts, marking in graphite of sections to be separated; [B] Sectioned tooth, separated into crown and two parts of root; [C] Dental posts (“biological posts”); [D] Biological posts adapted to model.

1C, 2A and 2B). The radiographic examination revealed pulp and apex involvement in the right and left lateral incisors (Figure 1B).

A significant improvement in the patient’s oral hygiene would allow the possibility of restoring the permanent central maxillary incisors using photo-activated composite resin and restructuring the permanent lateral maxillary incisors with the use of biological posts. For such, both the patient and mother received orientation regarding the advantages and disadvantages of the technique, the need for adequate oral hygiene and dietary habits and clarifications regarding other treatment options. It was also explained that the post and crown would be obtained from natural extracted teeth that had been duly donated and sterilized in an autoclave in compliance with commonly accepted biosafety standards. After agreeing to undergo the proposed treatment, both the patient and her mother signed a statement of informed consent.



Figure 2. Full isolation of operatory field; [A] Vestibular aspect; [B] Palatine aspect .

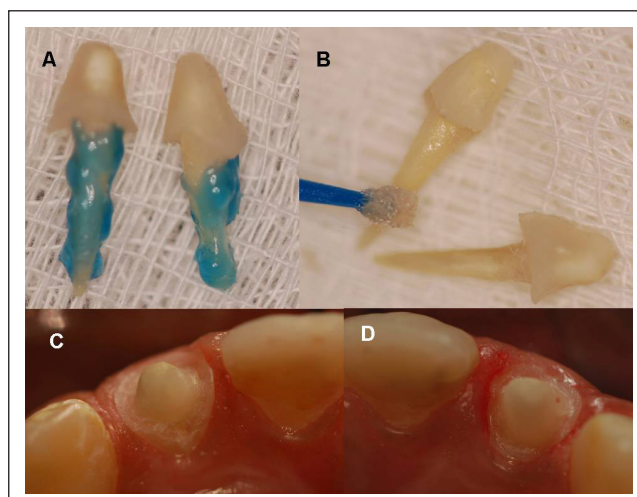


Figure 4. Cementing of biological posts and preparation for full crown of maxillary lateral incisors; [A] Conditioning of root portion of posts with 37% phosphoric acid; [B] Application of primer/adhesive; [C and D] Biological posts cemented and preparation of remaining dental tissue in chamfered cervical end.

Esthetic Restoration of Central Maxillary Incisors Using Composite Resin and Endodontic Treatment of Lateral Maxillary Incisors

In the first session, prophylaxis was performed on all teeth and all carious tissue was removed from the lateral and central maxillary incisors prior to the planned treatment. Steps were taken to protect the dentin-pulp complex and the esthetic restoration of the central maxillary incisors was performed using photo-activated composite resin (Z250, ESPE, USA).

Due to crown destruction and damage to pulp vitality caused by the dental caries, endodontic treatment of the lateral maxillary incisors was performed with intra-canal posts, the aim of which was to secure the crown restoration. For such, the root canals were prepared and direct molding of the canals was performed using addition silicone (ADSIL, Vigodent SA, Rio de Janeiro, Brazil).

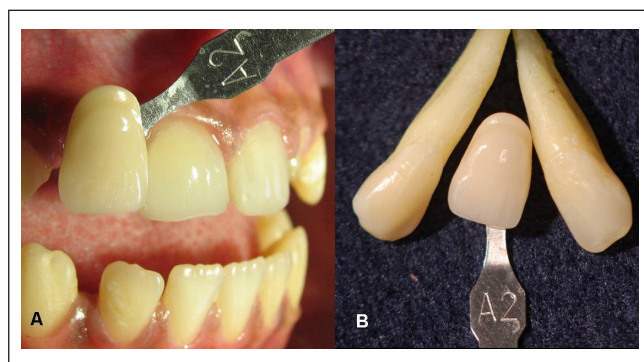


Figure 5. [A] Clinical selection of color; [B] Selected extracted teeth.

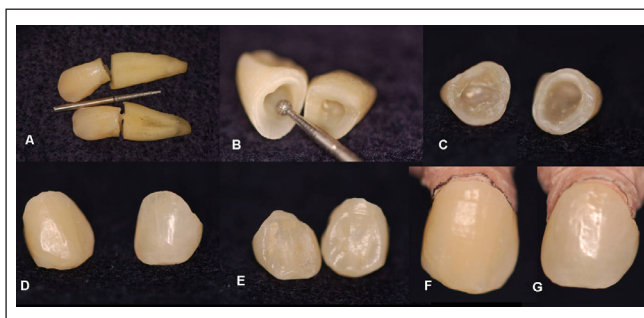


Figure 6. Obtaining of biological crowns; [A] Separation of root and coronary portions; [B] Beginning of cuts using spherical diamond tip, leaving crowns hollow; [C] Internal aspect of cut-out crowns; [D] Vestibular aspect; [E] Palatine aspect; [F and G] Biological crowns adapted to casts.

Making of Dentinal Posts

In the laboratory, the plaster model was made from the mold and donated extracted teeth were selected for the construction of the posts. The selected teeth were autoclaved at 121 °C for 15 minutes¹⁰ and sectioned, separating the crown portion from the root. The roots were then sectioned in the vestibular-lingual direction along the axis of the teeth (Figure 3A and B). The cementum and root canal were removed mechanically using diamond tips, maintaining only the dentin portions (Figure 3C). To facilitate the viewing of the post shape to be cut, a mold of each root was made with acrylic resin (Duralay, Reliance Dental Mfg. Co., Worth, IL, USA).

Adaptation and Cementing of Posts to Root Canals

Using diamond tips at high rotation and constant refrigeration, the biological posts were cut until achieving complete adaptation to the plaster model (Figure 3D). The posts were then etched with 37% phosphoric acid for 30 seconds, followed by the application of the primer/adhesive (ADPER SINGLE BOND 2, 3M ESPE, CA, USA). The posts, together with the chemically activated resin cement, were then added to the pre-isolated plaster model (C&B CEMENT, Bisco, Schaumburg, IL, USA), with the aim of facilitating the insertion axis and the adaptation of the posts in the root during cementation. Next, a filling nucleus consisting of photo-activated composite resin was established in the part of the post located on the outer portion of the root (Z250, ESPE, USA) to allow retention to the biological crowns.

The manufactured posts were then checked clinically and radiographically to determine whether they were satisfactorily adapted to

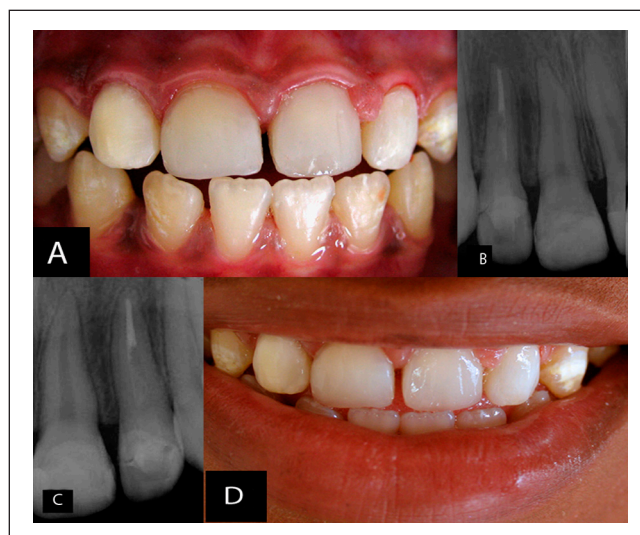


Figure 7. [A] Final clinical aspect; [B and C] Final radiographic aspect of teeth 12 and 22, respectively; [D] Final aspect of smile.

the root canals of the lateral maxillary incisors. For the cementing of the posts, both the inner portion of the canal and the surfaces of the posts were etched with 37% phosphoric acid for 15 seconds, followed by the application of the bonding system and the polymerization of the canals (Figure 4A and B). The posts were placed within the canals and pressure was applied until the chemically activated resin cement had cured (C&B CEMENT, Bisco, Schaumburg, IL, USA) (Figure 4C and D).

Preparation and Molding of Crown Portions, Model Construction and Choice of Extracted Teeth

The preparation of the remaining dental tissue in the oral cavity was carried out on the chamfered cervical end, exhibiting mostly enamel on the entire cavosurface. This preparation allowed the fragments to be cut for the construction of the biological crowns with an adequate thickness of enamel and dentin throughout the entire crown. After the molding prepared with addition silicone (ADSIL, Vigodent SA, Rio de Janeiro, Brazil), new plaster models were obtained and temporary restorations with self-polymerizing acrylic resin were then performed.

The color of the teeth was chosen with aid of the VITA scale, using the color of the central maxillary incisors as well as that of the lower teeth as reference (Figure 5A). A2 was the color selected. Size and shape were also taken into consideration in the choice of extracted teeth to be selected and cut to manufacture the biological restorations (Figure 5B).

Making of “Biological Crowns”

In a second laboratorial stage, the teeth pre-selected to manufacture the biological crowns were autoclaved at 121 °C for 15 minutes.¹⁰ The roots were then removed and discarded (Figure 6A). The crown portions were prepared using a diamond tip under intensive refrigeration, initially leaving them hollow (Figure 6B and C). Subsequently, casts were cut and adjusted until completely adapted to the crowns (Figures 6D, E, F and G). To obtain more efficient cervical adaptation to the remaining dental tissue in the oral cavity, a rebasing of the crown in a plaster model was carried out. For

such, 37% phosphoric acid was applied for 15 seconds, followed by the application of the bonding system (ADPER SINGLE BOND 2, 3M ESPE, CA, USA) to the inner portion of the manufactured crowns. Chemically activated cement resin was then applied (C&B CEMENT, Bisco, Schaumburg, IL, USA) and the crowns were positioned in pre-isolated plaster models until the final polymerization of the resin cement had been achieved.

Cementation of “Biological Crowns”

Returning to clinical procedures, the success of the adaptation of the crowns to the remaining dental tissues in the oral cavity and the adjustments of the biological crowns was determined. Next, due to the impossibility of absolute isolation of the surgical field (always maintained dry through relative isolation), the bonding procedures were carried out initially through etching with 37% phosphoric acid for 30 seconds both on the crown portion of the remaining dental tissue as well as the inner portion of the manufactured crowns. This procedure was followed by the application of a primer/adhesive (ADPER SINGLE BOND 2, 3M ESPE, CA, USA). The crowns were filled with chemically activated resinous cement (C&B CEMENT, Bisco, Schaumburg, IL, USA) and maintained in position by applying pressure until full polymerization of the cement had been achieved. Excess cement was removed using an exploratory probe. Occlusal interferences were checked using carbon paper and a radiographic examination (Figure 7A, B, C and D).

In the same session, the instructions given to the patient regarding oral hygiene, dietary habits and proper dental care were reiterated.

DISCUSSION

There are currently a number of restoration techniques for anterior teeth that bring about some form of esthetic change. Restorations may be performed directly or indirectly with composite resin, esthetic facets or metal-ceramic and pure porcelain full crowns.¹¹

In the present study, the lateral maxillary incisors exhibited extensive crown decay due to carious lesions, but had healthy roots. It was therefore necessary to manufacture intra-canal supports (posts). These intra-canal posts can be pre-manufactured from fiberglass, carbon fiber or cast metal. However, none of these materials offers ideal biological, mechanical or dentinal properties.^{4,10} Biological posts have the advantages of adapting well to the root, offering mechanical retention and not causing stress to the dentin, characterizing a unique biomechanical (monoblock) system that is compatible with the restored tooth and is based on the bonding of the post, cementing agent and dental structure.^{4,6,7} Moreover, the adherence and compatibility of the materials used for crown and intra-canal reconstruction in biological restorations reinforce the weakened root, making it less susceptible to fracture due to the greater distribution of occlusal force.^{4,6,7,10} It should also be stressed that this type of post was only used in the present case after a detailed investigation and a conclusion had been reached that the patient did not exhibit bruxism (teeth clenching/grinding), deep bite or an accentuated loss of the vertical dimension, as these factors are considered contraindications for the technique and can lead to unsuccessful treatment.^{6,10}

Biological crowns for teeth with extensive caries offer the natural characteristics of dental structures, such as smoothness, surface shine, anatomic contour, natural color, hardness and resistance to

wear and tear, with only a small amount of resin exposed in the oral cavity. This technique also has a significant psychosocial impact on quality of life.⁵⁻⁷ However, the patient should be made aware of the need to dedicate special attention to oral hygiene and diet and avoid excessive force, as biological crowns are susceptible to future caries and both biological crowns and posts can suffer fractures.^{5-7, 9,12}

The greatest difficulty encountered with this technique is the acquisition of extracted teeth with color, shape and size compatible with the dental structures to be restored, as the different fragments should exhibit similar characteristics to each other and the patient's other teeth as well as the appropriate dimensions for correct adaptation. This difficulty is related to the relatively infrequent extraction of healthy maxillary anterior permanent teeth, which underscores the need to establish a larger Tooth Bank in Brazil and non-profit institutions that collect, store, sterilize and supply teeth for educational, clinical or scientific purposes.^{6,13} Moreover, this technique poses a challenge and requires a certain level of skill on the part of the dental surgeon.^{5, 8}

CONCLUSION

The use of a composite resin and the cementing of “biological posts and crowns” reestablish dental esthetics and function. Biological restorations maintain all the characteristics of natural teeth and have a significant psychosocial impact on the patient's quality of life. However, it should be stressed that this technique was only indicated in the present case after the determination of a significant improvement in the patient's oral hygiene.

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