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CASE REPORT

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Endocrown: a conservative approach

Endocrown: uma abordagem conservadora

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ABSTRACT

The purpose of this clinical case description article was to present the planning sequence, indication, treatment and performance to obtain a crown of the Endocrown type. This clinical case description article illustrates a therapeutic option for functional and esthetic rehabilitation of a devitalized mandibular molar, presenting a small amount of remaining coronal tooth structure, by means of cementing a pure porcelain crown of the Endocrown type (Adhesive Endodontic Crown). A 39-year-old woman presented to the Graduate clinic of the Bauru Dental School (FOB), University of São Paulo (USP), with the complaint that tooth #36 had an extensive and unsatisfactory composite resin restoration. The lithium disilicate-based system of monolithic porcelain was used with the lost wax technique. This therapy promoted the stability and retention of the indirect restoration, without the need for performing reconstruction of the above mentioned tooth, either by means of a cast metal core or reconstruction with intracanal post, thereby reducing the treatment time. After the tooth preparation, the provisional restoration was done with acrylic resin to determine if the retention and stability of the remaining tooth was adequate to receive the indirect Endocrown restoration. The characteristics of the internal and external walls of the dental remnants, cervical termination, impression-taking, laboratory stages and adhesive cementation will be discussed. The major advantage of indicating an endocrown is the use of the dental remnants itself, particularly the pulp chamber, to promote retention and stability in cases without adequate height for performing complete dental and crown reconstruction.

KEYWORDS

Dental cements; Crowns; Tooth, nonvital; Lithium dissilicate.

RESUMO

O objetivo deste artigo de descrição de caso clínico foi apresentar a sequência de planejamento, indicação, tratamento e execução de uma coroa do tipo Endocrown (Coroa Endodôntica Adesiva). Este artigo ilustra uma opção terapêutica para reabilitação funcional e estética de um molar inferior desvitalizado, apresentando uma pequena quantidade de remanescente coronário, por meio da cimentação de uma coroa pura de porcelana do tipo Endocrown. Uma mulher de 39 anos de idade, apresentou-se à clínica de Pós-Graduação da Faculdade de Odontologia de Bauru (FOB) da Universidade de São Paulo (USP), com a queixa de uma extensa e insatisfatória restauração de resina composta no dente 36. O sistema monolítico de porcelana à base de dissilicato de lítio foi utilizado com a técnica da cera perdida. Esta técnica promoveu a estabilidade e a retenção da restauração indireta, sem a necessidade de realizar a reconstrução do dente 36, quer por meio de um núcleo metálico fundido ou reconstrução com pino intracanal, reduzindo assim o tempo de tratamento. Após o preparo do dente, realizou-se a restauração provisória com resina acrílica e verificou-se se a retenção e estabilidade do remanescente dentário era adequada para receber a restauração do tipo Endocrown. As características das paredes internas e externas do preparo do remanescente dentário, término cervical, moldagem, etapas laboratoriais e de cimentação são discutidas. A principal vantagem da indicação de uma coroa do tipo Endocrown é a utilização do próprio remanescente dentário, particularmente a câmara pulpar, para promover a retenção e estabilidade em casos onde não haja altura adequada para a reconstrução coronária.

PALAVRAS-CHAVE

Cimentos dentários; Coroas; Dente não vital.

INTRODUCTION

One of the most frequent problems dentists face is the restorative treatment of endodontically treated teeth with extensive coronal destruction, whose esthetic and functional recovery generates a great deal of confusion. In cases in which there is insufficient dental crown height in relation to the antagonist teeth, the fabrication of a total crown restoration of the Endocrown (Adhesive Endodontic Crown) type supported on a metal core or filling is an excellent option.

Various authors have proposed the treatment of these teeth with total crowns supported by a cast metal core [1,2]. With the development of intraradicular fiber posts and the technique for bonding to dentin, the technique for restoring endodontically treated teeth has been simplified, in addition to costing less and being biocompatible [3,4]. However, the use of intraradicular posts alone does not guarantee the strength of the restorations, and the fabrication of filling cores is necessary to ensure greater stability [4,5].

The association of post and filling core, when performed with the correct technique and indication, presents satisfactory long term results. However, the limitations to the use of intraradicular posts, such as the root anatomy, presence of dilacerations and short roots, reduction in the strength of the tooth (as a result of dental structure stripping in order to insert the post), the complexity of treatment in some cases, high cost and doubts with regard to cementation material, have lead clinicians to seek other alternatives, such as the use of adhesive endodontic crowns, also called Endocrowns [6,7].

Cases of endodontically treated teeth, in which it is impossible to place an intracanal post, or those that have insufficient coronal height, extensive destruction, and require additional stripping of dental structures, may be more easily recovered with the fabrication of restorations of the total Endocrown type. This treatment consists of fabricating onlays, overlays and total crowns that use the entire depth, extension and inclination of the internal walls of the pulp chamber to promote stability and retention of the restoration, without the need to remove obstructions (such as filling materials) from the root canals [5,8-10].

The constant quest for satisfactory esthetics and function, allied to the professionals' need to promote lasting treatments, have determined the use of metal free crowns as an excellent alternative. Among the various metal free systems, the IPS E.max (Ivoclar Vivadent, Barueri, Brazil) is composed of a very versatile, vitreous lithium disilicate-based ceramic, obtained by the lost wax technique and injection of porcelain. According to the literature, this has presented excellent results regarding the clinical performance, naturally and beautifully reproduces the dental structure, in addition to presenting excellent mechanical and esthetic properties [11,12].

Therefore, the aim of the current study was to present a clinical case, in with a total crown of the endocrown type was used to rehabilitate a mandibular molar that presented endodontic treatment and extensive coronal destruction.

CASE REPORT

The patient, a 39-year-old woman, presented to the Graduate clinic of the Bauru Dental School (FOB), University of São Paulo (USP), with the complaint that tooth #36 had an extensive and unsatisfactory composite resin restoration (Figure 1A), involving all the cusps, and a short coronal portion (Figure 1B). After a radiographic exam, the presence of duly filled root canals was found (Figure 2). In clinical planning, the removal of restorative materials and fabrication of an adhesive endodontic crown (Endocrown) made of pure lithium disilicate-based porcelain was indicated.

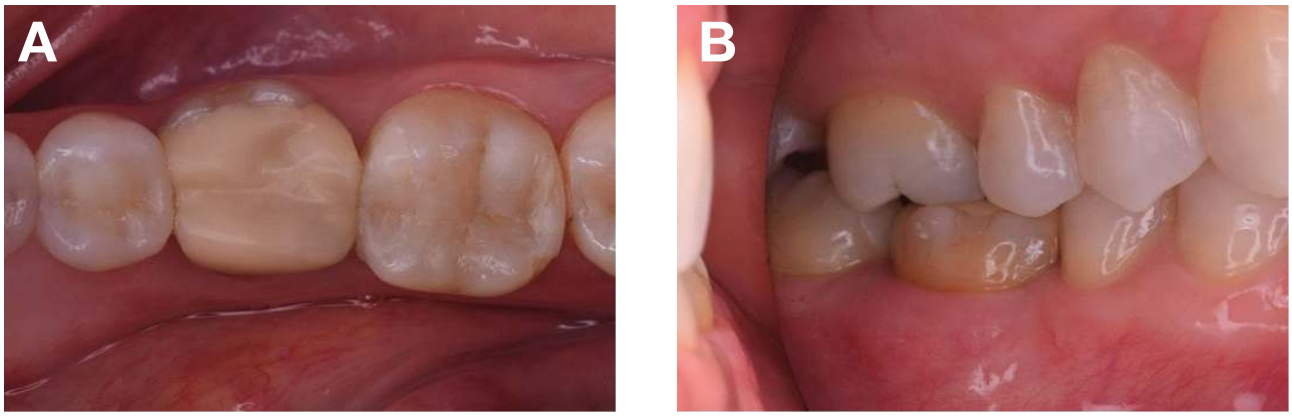

Figure 1 - A) Clinical condition of tooth #36 with extensive resin composite restoration; B) Side view, relationship of crown height in occlusion with the antagonist tooth.

Figure 2 - Initial radiograph showing the filling of root canals, normal periapical aspect, presence of radiopaque material within the pulp chamber and retentive artifacts.

In the first session, the working models were obtained by taking impressions of the mandibular and maxillary hemiarches, using Optosil Xantopren (Heraeus, Hanau, Germany) condensation silicone and maxillary impression taken with Jeltrate (Dentsply, Petrópolis, Brazil) irreversible hydrocolloid. The models were mounted in a verticulator (BioArt, São Carlos, Brazil) (Figure 3A) in order to fabricate the provisional restoration by the MIT technique (Modified Indirect Technique) recommended by Fraudeani [13] (Figures 3B and C). This technique makes it easier to obtain the best shape, function and esthetics in the shortest clinical time. After obtaining the impression, a silicone matrix and another rigid acetate model were fabricated. By means of the silicone matrix, the provisional restoration was fabricated with heat activated acrylic resin (Refine Bright – Yamahachi, Kota Imports, São Paulo, Brazil), while the purpose of the acetate matrix was to place the provisional restoration into the correct position at the time of relining.

In the second session, all the unsatisfactory restorative material was removed from tooth #36, using a diamond-coated rounded tip 1014 (KG Sorensen, Barueri, Brazil). Acrylic resin-based material and metal orthodontic wires at the entrances of the root canals were found within the pulp chamber, which were completely removed (Figure 4). After this, the canal entrances were sealed with conventional, chemically activated glass ionomer cement (Vidrion R, SSWhite, Rio de Janeiro, Brazil), injected with the aid of a Centrix syringe (DFL, Rio de Janeiro, Brazil) (Figure 5). Afterwards, the cervical termination was determined in a deep chamfer, and the expulsive degree of the external surrounding walls, as well as the internal walls of the pulp chamber, using diamond-coated tips 2145, 2136 and 4138 (KG Sorensen, Barueri, Brazil). In the same session, the provisional restoration was adapted, using the acetate matrix, and relining performed with self-polymerizing acrylic resin (TDV, Santa Catarina, Brazil) (Figures 6A and B). Next, polishing was performed, paying

special attention to the cervical third region of the provisional restoration, in order to eliminate possible irregularities that could compromise gingival hemostasis. The restoration was cemented with eugenol-free temporary cement (Temp Bond, Kerr, Orange, USA) (Figure 6C).

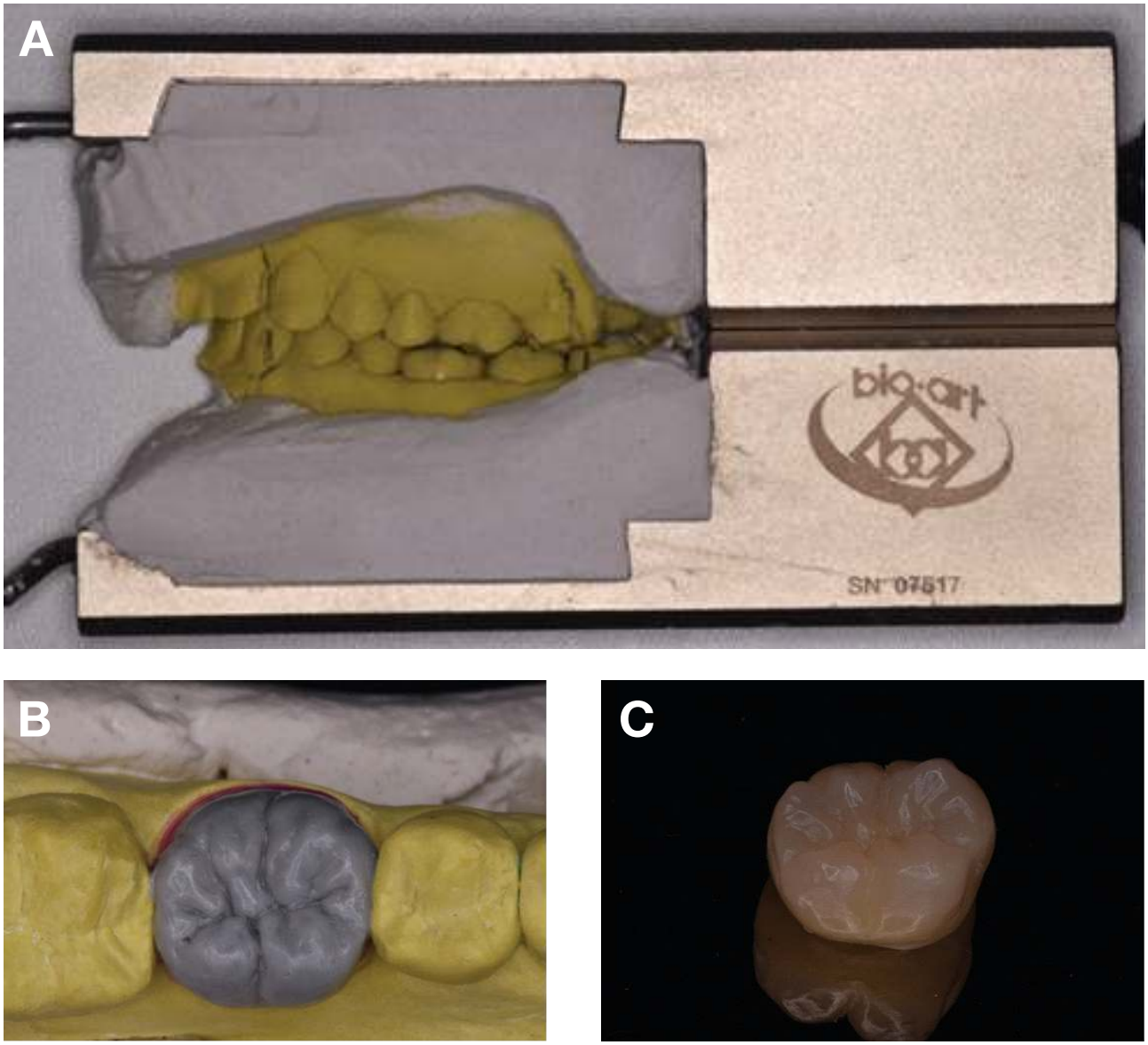

Figure 3 - A) Working models mounted in the Verticulator (BioArt, São Carlos, Brazil); B) Waxing for fabrication of the provisional restoration by the MIT technique; C) Aspect of the finished provisional acrylic resin restoration.

Figure 4 - Initial aspect after removal of the unsatisfactory resin restoration. Note the presence of acrylic resin within the pulp chamber, with orthodontic wire as retentive element.

Figure 5 - Lining the root canal entrances with glass ionomer cement.

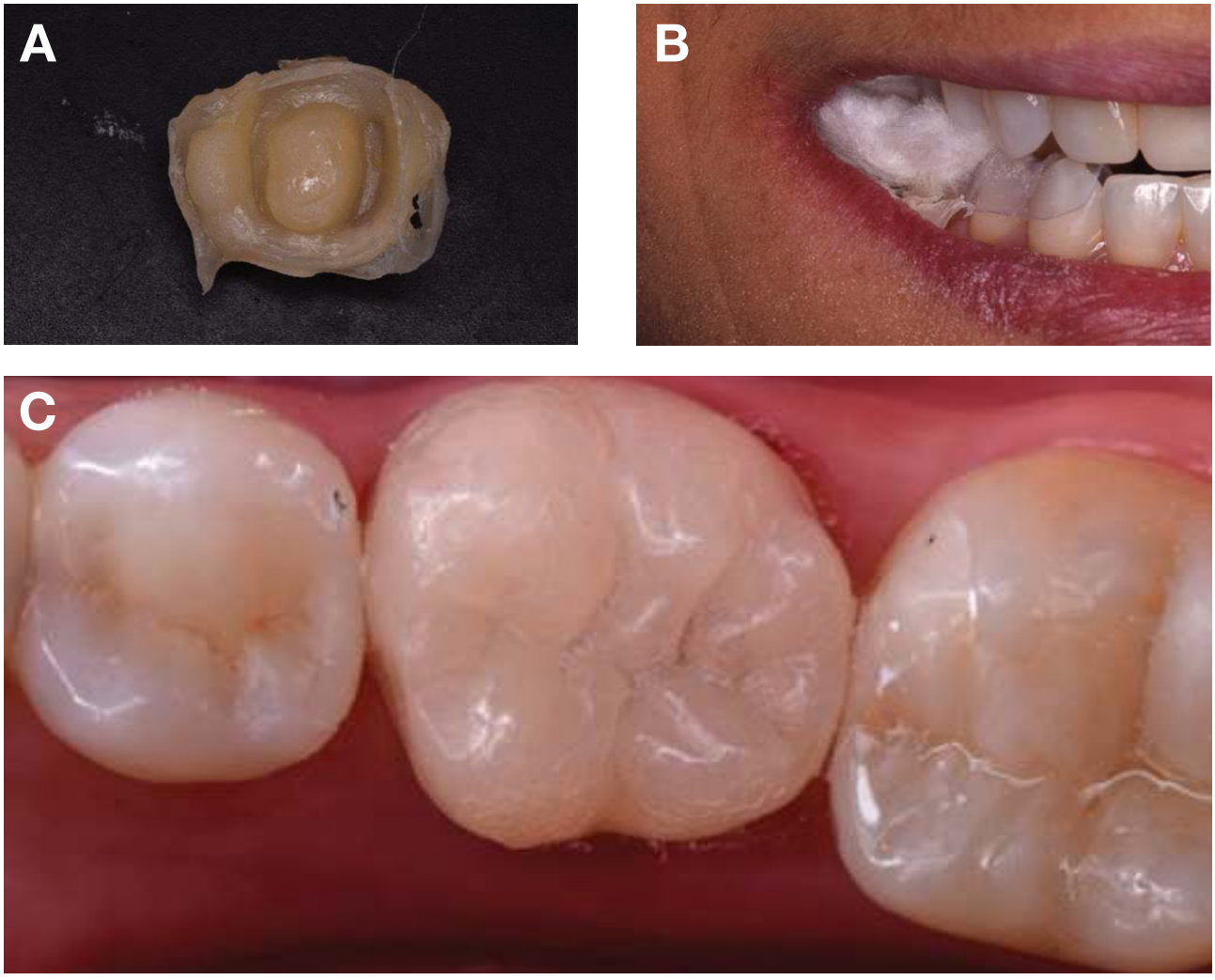

Figure 6 - A) Relining the provisional restoration with acrylic resin; B) Positioning the provisional restoration using the acetate plate of the MIT technique; C) Cementation

After 7 days, the provisional restoration was removed and prophylaxis was performed, which allowed verification of gingival health and integrity. After this, a #000 Ultrapack (Ultradent, South Jordan, USA) retractor cord, soaked in Hemostop (Dentsply, Mannheim, Germany), hemostatic liquid, was inserted to control crevicular exudate from the gingival sulcus, allowing better visualization of the cervical termination, which was fine finished using a diamond-coated tip 2135FF (KG Sorensen, Barueri, Brazil). After concluding the refinement of the preparation, a second retractor cord, #0 Ultrapack (Ultradent, South Jordan, USA) also soked in Hemostop (Dentsply, Mannheim, Germany), hemostatic liquid, was inserted for five minutes to enable lateral withdrawal of the gingiva and allow the impression-taking material to enter into the crevicular sulcus (Figure 7A).

The impression of the tooth was taken by the double-impression technique. In the first stage, heavy consistency addition silicone (Express, 3M ESPE, Saint Paul, USA) was used, with the aid of a sheet of plastic placed over the mold (Morelli, Sorocaba, Brazil), to generate space for the light material. For the second stage impression, the light paste was applied with an auto-mix dispensing gun (3M ESPE, Saint Paul, USA) directly onto the tooth, simultaneously with the removal of the second retractor cord, and in the mold (Figure 7B).

After visualization and analysis of the quality of the impression, the provisional restoration was relined and cemented with Temp Bond (Kerr, Orange, USA). To select the ceramic shade, the Vita Classic scale (Vident, Brea, USA) was used.

At this laboratory stage, the model was poured twice, with the die of the first model being obtained by the alveolus technique [14] (Figure 8A). Waxing (Crowax - Renfert, Saint Charles, USA) was progressively performed and the wax was sculptured accordingly Kano [15] (Figures 8B and C). The wax pattern of the Endocrown crown was included, and filled with Durone (Vigodent, Rio de Janeiro, Brazil) lining plaster and taken to the Programat EP 3000 (Ivoclar Vivadent AG, Schaan, Principality of Liechtenstein) furnace using the lost wax technique, for 15 min at 906oC degrees. Next, the Lithium disilicate LT tablet, shade A2 (Ivoclar Vivadent, Barueri, Brazil), was injected into the EP 600 Ips Empress programmable ceramic press furnace (Ivoclair Vivadent, Jakarta, Indonesia), resulting in the fabrication of a monolithic crown in a single block.

In the following session, the patient returned for a try-in of the crown and to test the

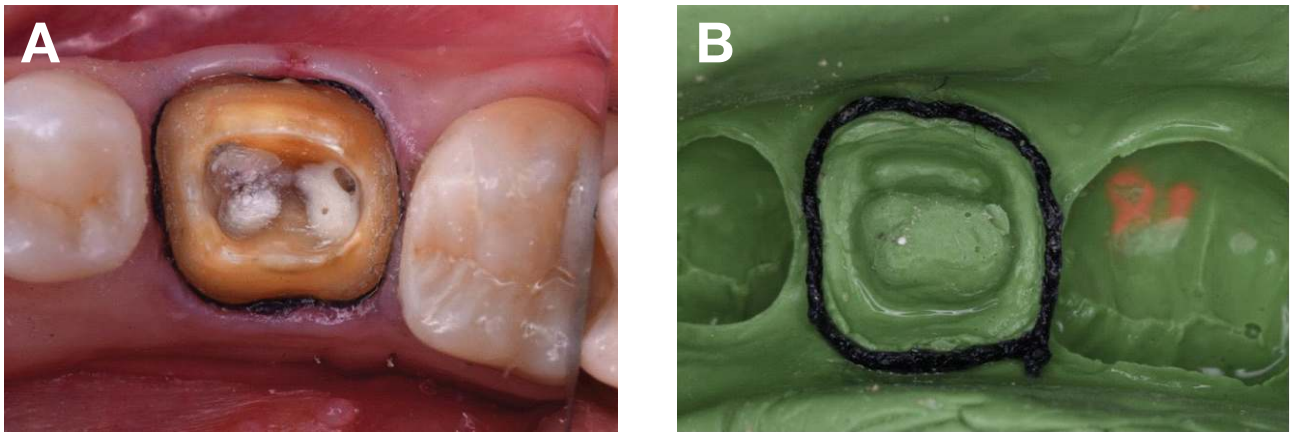

Figure 7 - A) Insertion of the retractor cord Ä000 Ultrapack; B) Impression-taking of the dental preparation with the addition of silicone by the two-cord technique; One notes the presence of Ä0 Ultrapack retractor cord in the impression.

occlusion, internal and proximal adjustments, since this type of indirect restoration has sufficient thickness for adjustments to be performed before cementation. Right after this, the Endocrown was sent back to the laboratory for application of the colorant and glaze (Ivoclar Vivadent, Barueri, Brazil) (Figure 9).

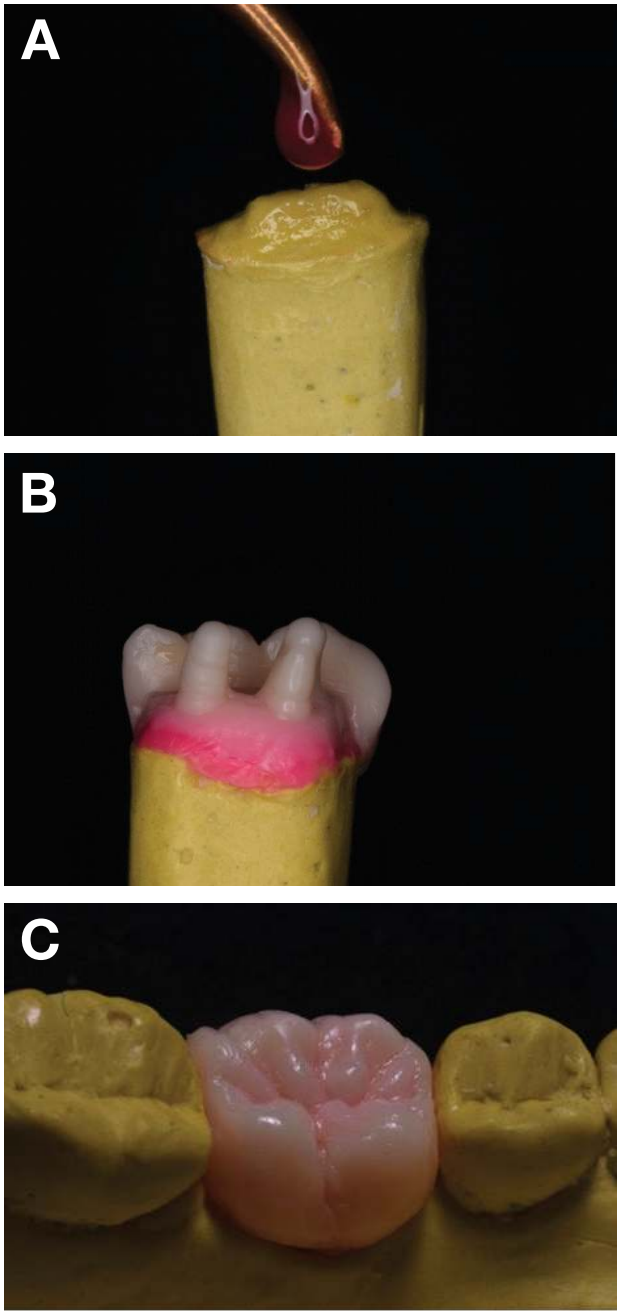

Figure 8 - A) Die of the alveolar or Geller model; B) Progressive waxing; C) Final aspect of waxing.

Figure 9 - Application of make-up and glazing on the prosthetic part.

The external cervical margin of the crown was protected with wax and then etched with 10% hydrofluoric acid (FGM, Joinville, Brazil) for 20 s (Figure 10A), abundantly washed and dried. Next, two coats of Monobond Silane (Ivoclar Vivadent, Barueri, Brazil) were applied, with a 1-minute interval between each application (Figure 10B). After solvent evaporation, the Scotchbond Multi-Purpose Plus adhesive agent (3M ESPE, Saint Paul, USA) system was applied, without polymerization. Next, the tooth was treated with 37% phosphoric acid (FGM, Joinville, Brazil) for 15 s, then abundantly washed and dried, followed by the application of the Scotchbond Multi-Purpose Plus adhesive system (3M ESPE, Saint Paul, USA) (Figure 11). The primer and adhesive were applied in accordance with the manufacturer's instructions, using a microbrush (KG Sorensen, Barueri, Brazil) and polymerized for 20 s with a Radii-Cal, 1200 mW/cm^2, (SDI, São Paulo, Brazil) light-curing appliance.

For cementation, the All Ceram Core dual cement (FGM, Joinville, Brazil) shade A2 was used. It was proportioned, manipulated and inserted into the tooth (Figure 12A), and a thin layer was applied to the prosthetic Endocrown, which was positioned, and polymerized at intervals of 5 seconds on the free surfaces, making it easy to remove cement excesses. Afterwards it was polymerized for 60 seconds on all surfaces (Figures 12B and C).

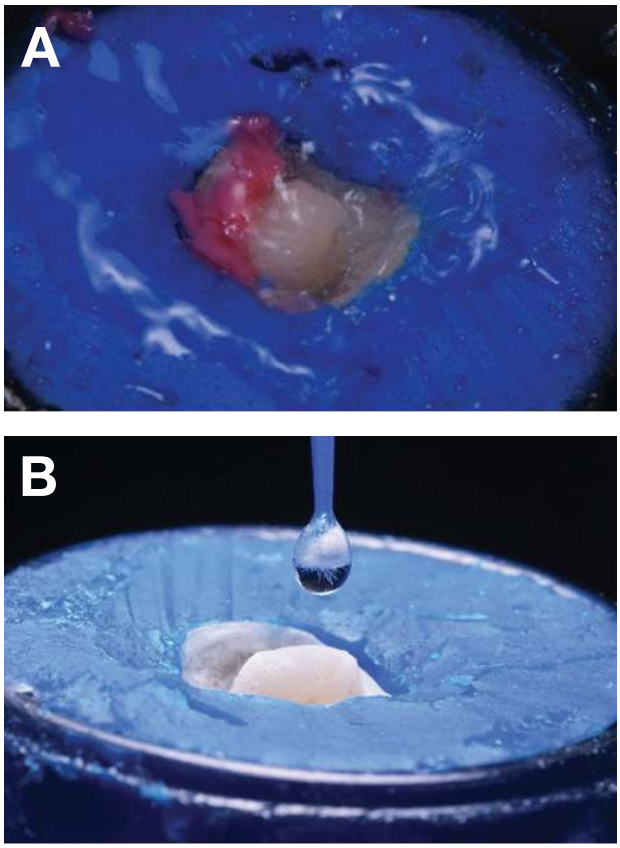

Figure 10 - A) Washing after etching with hydrofluoric acid; B) Silane application.

Figure 11 - Application of the adhesive agent on the remaining tooth structure.

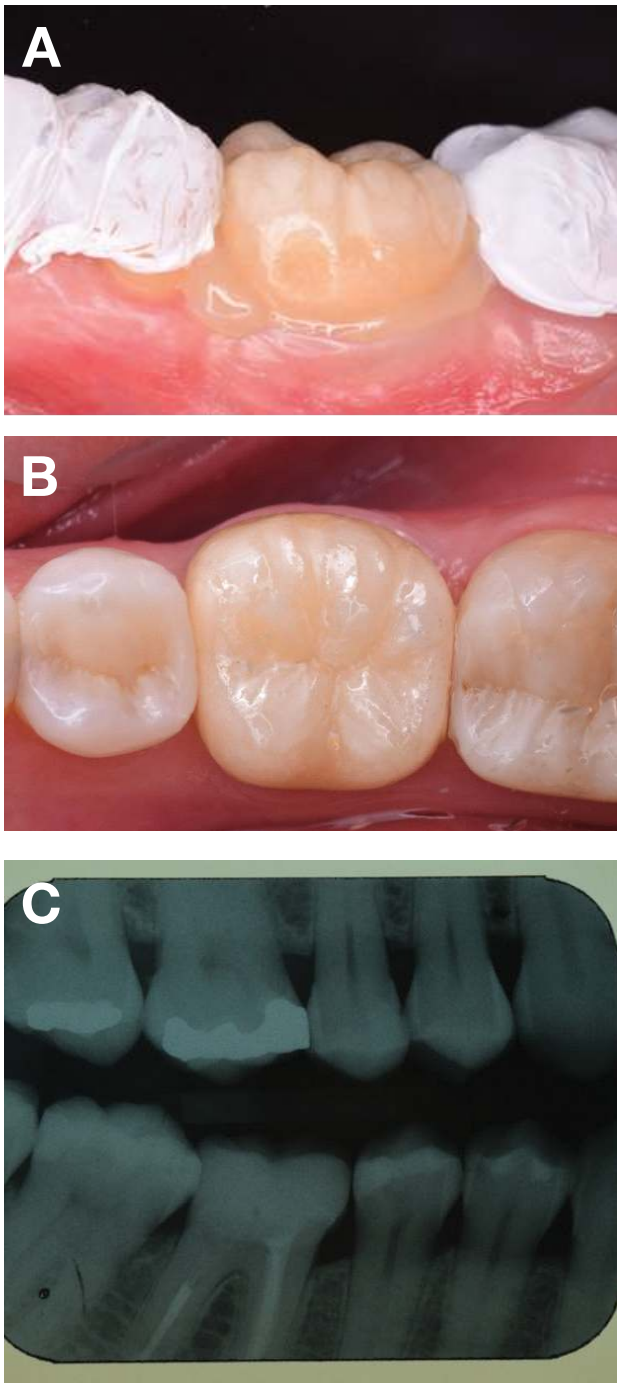

Figure 12 - A) Cementation of the prosthetic part; B) Final aspect of the restoration; C) Final radiograph.

DISCUSSION

Planning the restorative treatment of devitalized teeth is a challenge to the dentist, particularly with regards to the choice of the root retention system, making it difficult to decide which is the best treatment option to guarantee the clinical longevity of the treatment [16].

In addition to the type of retainer, the friability of the depulped teeth and variable root anatomy [6,7] and the risk involving a possible

root perforation during preparation [17], make it even more difficult to choose the most adequate rehabilitative treatment for these teeth.

Endocrown is a technique suitable for cases where there is great loss of tooth structure, small interproximal space and traditional rehabilitation with post and crown is not possible because of inadequate ceramic thickness [18].

This has been shown to be an advantageous technique because the procedure is easy and have a mechanical performance better when compared with conventional crowns, costs less because of the fewer number of steps involved, demands less clinical time and has good esthetic acceptance [18-20].

In a similar manner, one of the main doubts involve the choice of cement for the fixation of intraradicular posts, considering the innumerable commercial brands in the market, as well as the quality and quantity of cement and its polymerization, relationship with the root canal length, and the cavity configuration factor (C Factor) [21,22]. There is also the possibility of the presence of air bubbles forming during the insertion of the cement and placement of the glass fiber post [23]. Therefore, simpler, faster and more conservative alternatives for the restoration of endodontically treated teeth with a short crown are the restoration denominated endocrowns [8,10].

The principles that govern preparation for the endocrown follow the same pattern as the principles for preparations for indirect Inlay and Onlay restorations: slightly expulsive axial walls (10-12º), and a flat pulp chamber floor. To facilitate the subsequent steps of impression-taking, adjustment and cementation, this option was taken to maintain a supragingival cervical termination.

The MIT technique (Modified Indirect Technique) for fabricating the provisional restoration, recommended by Fraudeani [13] is more effective for the rehabilitation of more than one tooth, because it enables greater economy of clinical time and material, in comparison with the direct fabrication technique. In the latter, it is necessary to perform relining several times, until marginal adaptation is obtained, due to the inevitable polymerization shrinkage of the heat activated acrylic resin [24].

Furthermore, we opted for this technique because it presents excellent finishing and polishing, good anatomy and morphology, with guarantee of convexity for protection of the periodontium, in addition to being fabricated with an acrylic resin with better properties (Refine Bright – Yamahachi, Kota Imports, São Paulo, Brazil).

For fabrication of the endocrown, a monolithic, lithium dissilicate-based ceramic, IPS e.max (Ivoclar Vivadent, Schaan, Liechtenstein) was used, which has adequate physical properties and greater translucence [25]. According to the manufacturer, there are two types of ceramics of the IPS e.max system: the monolithic type with an occlusal dimension of 1.5 mm thickness, without the need for a later porcelain coating; and the lithium disilicate coping (minimum 0.8 mm) covered with a porcelain coating (maximum 0. 7 mm). Both have sufficient strength for the restoration of posterior teeth (=/- 400 MPa), in addition to not promoting excessive wear of the antagonist teeth [26].

There is also the possibility of using CAD/CAM for fabricating restorations in a single block. However, considering that the walls of the preparation were very thin, the option was to use ceramic injection by the lost wax technique [27].

Our option to use dual cement was justified by the fact that the light-curing unit light needed to pass through the ceramic thickness. AllCem is a permanent adhesive resin, dual polymerizing cement; it is radiopaque and has a wide spectrum of application in indirect restorations. The combination of the two polymerization mechanisms, physical and chemical, guarantee polymerization of the product in situations even

in the absence of access to light. It has adequate bonding and mechanical properties, and is also easy to apply due to the double-bodied syringe that self mixes the cement and prevents the incorporation of air bubbles into it.

Pre-polymerization of the cement allowed the removal of excesses more easily, without the need for mechanical withdrawal of overhanging cement which might have resulted in trauma to the marginal gingival tissue, and can lead to undesirable gingival recession.

For the clinical success of a restoration with an adhesive endodontic crown, correct indication of the restorative treatment is essential. The choice of a ceramic system such as monolithic lithium dissilicate is an adequate technique for fabricating the provisional restoration, which guarantees gingival health and avoids movement of the tooth, and precise impression-taking with good quality material [28].

CONCLUSION

Based on this case report, the production of endocrowns using monolithic IPS e.max by the lost wax technique may be considered a safe option for the restoration of endodontically treated posterior teeth. However, longitudinal clinical studies are necessary.

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