Biological restorations as an alternative treatment for primary posterior teeth

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A case of oral rehabilitation in a 4-year-old girl, in which the posterior teeth were restored using biological restorations, is described. The tooth fragments were selected from a bank of tooth tissues and bonded with dual-cure composite cement to prepared teeth. The results were satisfactory regarding retention, aesthetic and mastication, but disadvantages included long clinical appointments, laborious technique and possible fracture or degradation between the margins of the fragment and the tooth surface.
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INTRODUCTION

Restoration of primary teeth extensively destroyed by carious lesions has been a challenge in Pediatric Dentistry, especially when patients are very young. Regarding aesthethics for these cases, there are currently no options of materials to be used in operative dental treatment for severely destroyed teeth. In spite of being a non-aesthetic restorative material, pre-formed stainless steel crowns remain widely used in pediatric dental practice.[1-4]

The use of adhesive techniques to bond dental fragments to teeth has been proposed as an aesthetic alternative for restoration of severely destroyed primary teeth.[5,6] This technique was first used for restoration of fractured teeth using the own fractured tooth crown.[7,8] In 1991, the term "biological restoration" was introduced to describe an alternative technique that uses adhesive capabilities of materials in combination with strategic placement of parts of extracted human permanent teeth to achieve better esthetics and more conservation of sound dental tissue.[9] Since then, an excellent success rate has been reported for permanent teeth.[10] Regarding primary teeth, Tavares *et al.*[6] were the first authors to describe a case in which tooth fragments were used to restore carious elements.

The aim of this article is to present a case in which biological restorations were used to restore six primary posterior teeth severely destroyed by dental caries in a young patient.

CASE REPORT

A four-year-old Afro-American female presented to the Pediatric Dental Clinic at the Federal University Dental School in Rio de Janeiro, Brazil, with a chief complaint of pain in a mandibular primary molar. Her medical history was unremarkable, but the mother revealed that the girl was very shy and unhappy about the smile aesthetic. During extra-oral examination no alterations were observed. Intra-oral examination revealed a swelling near the right lower second primary molar and cavitated carious lesions were observed in all primary molars, maxillary incisors and cuspids (Figures 1A and 1B). Oral hygiene was very poor and the patient exhibited generalized gingivitis. The parents received diet counseling and oral hygiene instructions.

Radiographic examination revealed that maintenance of the lower right second primary molar and both upper central primary incisors were not indicated and that the remaining molars exhibited pulpal involvement. Teeth numbers 51, 61 and 85 were extracted and space maintainers were done for these regions. Teeth numbers 55, 64, and 75 received pulpectomy treatment using an iodoformed paste,[11] while teeth numbers 54, 65, 74 and 84 were treated by conventional formocresol pulpotomy.[12] Figures 1C, 1D, 1E and 1F present periapical radiographic examination of each quadrant after pulpal treatments and space maintainer placement.

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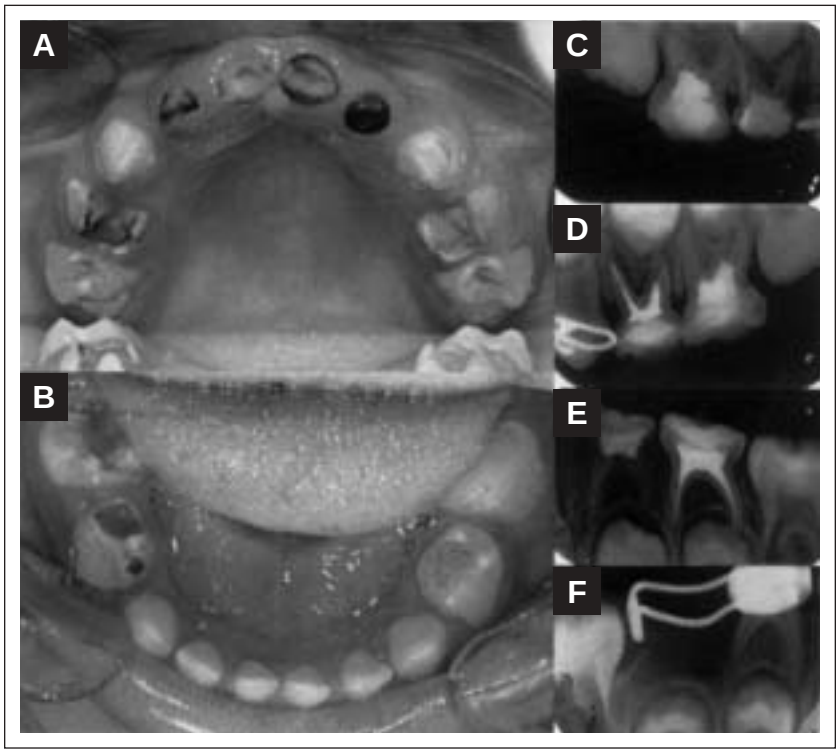

Figure 1 A. Upper arch initial clinical aspect. **B.** Upper arch initial clinical aspect. Initial periapical radiographs: **C.** 54 and 55, **D.** 64 and 65, **E.** 74 and 75, F. 84.

The lower right first primary molar was restored using composite and reconstruction of the others posterior teeth was performed with biological restorations. Teeth numbers 55, 54, 65, 64, 74 and 75 were filled with light-cured glass ionomer cement (Fuji II LC®, ESPE) and non-retentive preparations were performed. These included reduction of the ionomeric base to a depth of 2mm, regularization of cavity walls and rounding of cavity angles (Figure 2A). The teeth were reduced in occlusal height to loose the contact point to the antagonist. After, a silicone base material (Optosil and Xantopren® – Halroes-Kulzer) was used for the impression (Figure 2B).

After impression, stone models were prepared with a type IV plaster (Durone®, Dentsply) (Figure 2C). In a laboratory phase, a similar tooth to the one that had been prepared was chosen according to the diameter and color, from a bank of tooth tissues (Figure 2D). In order to make adaptation easier, preparation limits were marked with graphite to enable visualization of those points that were impairing good adaptation (Figures 3A and 3B).

The selected tooth was shaped using a round bur in water-cooled high speed (Figure 3C), to adapt to the plaster model and this procedure was repeated until a satisfactory positioning was achieved (Figure 3D). The prepared fragments were sterilized in humid steam at 120˚C for 20 minutes.

Following appointment included local anesthesia, rubber dam placement and final adjustment of the fragments, on the patient. As a composite cement (Enforce®, Dentsply) was used as a lutting agent, bonding procedures followed this sequence: acid etching of the teeth and fragments for 15 seconds with 37% phosphoric acid (Figure 4A), adhesive application (Prime & Bond NT,™ Dentsply) (Figure 4B), and placement of the fragment filled with the cement with the aid of a gutta-percha stick (Figures 4C). Restorative composite was used to finish adaptation at the margins of the tooth and the dental fragment. After light polymerization, the margins were polished using finishing burs and composite polishing points and disks (Figure 4D). Carbon was used to check contact points and final adjustments were performed until proper contact was achieved.

Each group of contiguous teeth was restored in following appointments as described above. Figures 5A, 5B and 5C show the final aspect of each quadrant. By the end of the treatment the parents became very satisfied because the patient improved her social relationship. The mother revealed that the patient was always eager for next dental appointment to see the new teeth that she would receive. During clinical procedures an improvement in behavior was also evident.

Every third month, the patient is recalled for oral hygiene instructions and following of the space maintainers and the bonded restorations. A 6-month recall of the patient revealed satisfactory adaptation of the bonded fragments. However, teeth numbers 65 and 74

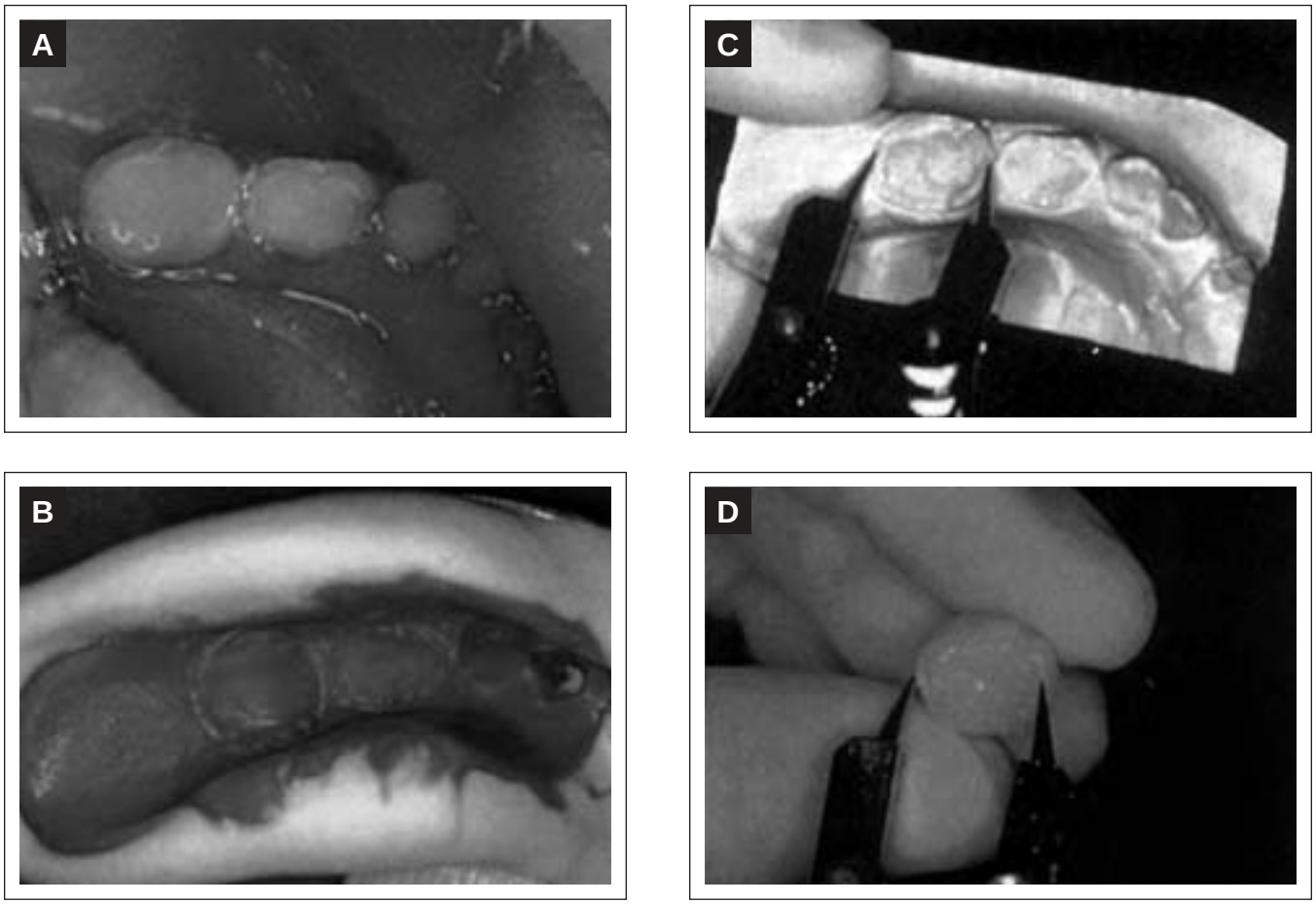

Figure 2. A. Teeth numbers 74 and 75 filled with glass ionomer cement and non-retentive preparations were performed. **B.** Impression utilizing a silicone base material. **C.** stone model in which a calligrapher was used to take the diameter of the prepared tooth. **D.** selection of a similar tooth to the one that had been prepared according to the diameter and color.

showed fractures in some portions of the bonded fragment. These were fixed with conventional dental composite (TPH Spectrum, Dentsply).

DISCUSSION

The use of biological restorations in primary teeth, which is the bonding of exfoliated/extracted tooth fragments from one child to another, is becoming very usual in Brazilian dental schools. However, even after eleven years of the first described clinical case of biological restorations in primary teeth[6] there are no legal procedures established for organization of tooth donation. Some dental schools already have bank for tooth tissues and are presently using biological restorations as an alternative treatment for stainless steel crowns or large composite restorations in severely destroyed primary teeth.[2,6] Besides legal implications, aspects of sterilization procedures and stocking methods are not stricktly defined.

It is undeniable that stainless steel crowns remain a very useful choice for great tooth reconstruction due to the perfect recovery of the vertical dimension, maintenance of space, low cost, small operative time and lack of need for a laboratory phase.[13] Aesthetic concerns remain one of the most drawbacks of the technique, together with difficulties on proper intercuspation. Besides, gingival inflammation may occur in consequence to the poor cervical adjustment and in some cases by the non-establishment of the correct proximal contact point.

The technique of biological restorations shows good aesthetics and adaptation regarding occlusal and cervical adjustment. The use of natural primary crowns allows the creation of a perfect occlusal anatomy and an effective plaque control due to enamel normal smoothness. Besides, Ramires-Rorito *et al.*[5] reported that these restorations are less subjected to extrinsic pigmentation when compared to composite restorations.

The present case, showed excellent aesthetic results but, during the follow up period, problems related to fracture of the margins were found. Also, the long time consumed for preparation of the fragments, bonding and occlusion checking were also great disadvantages. These had also been reported by some university teachers, who consider the technique difficult for

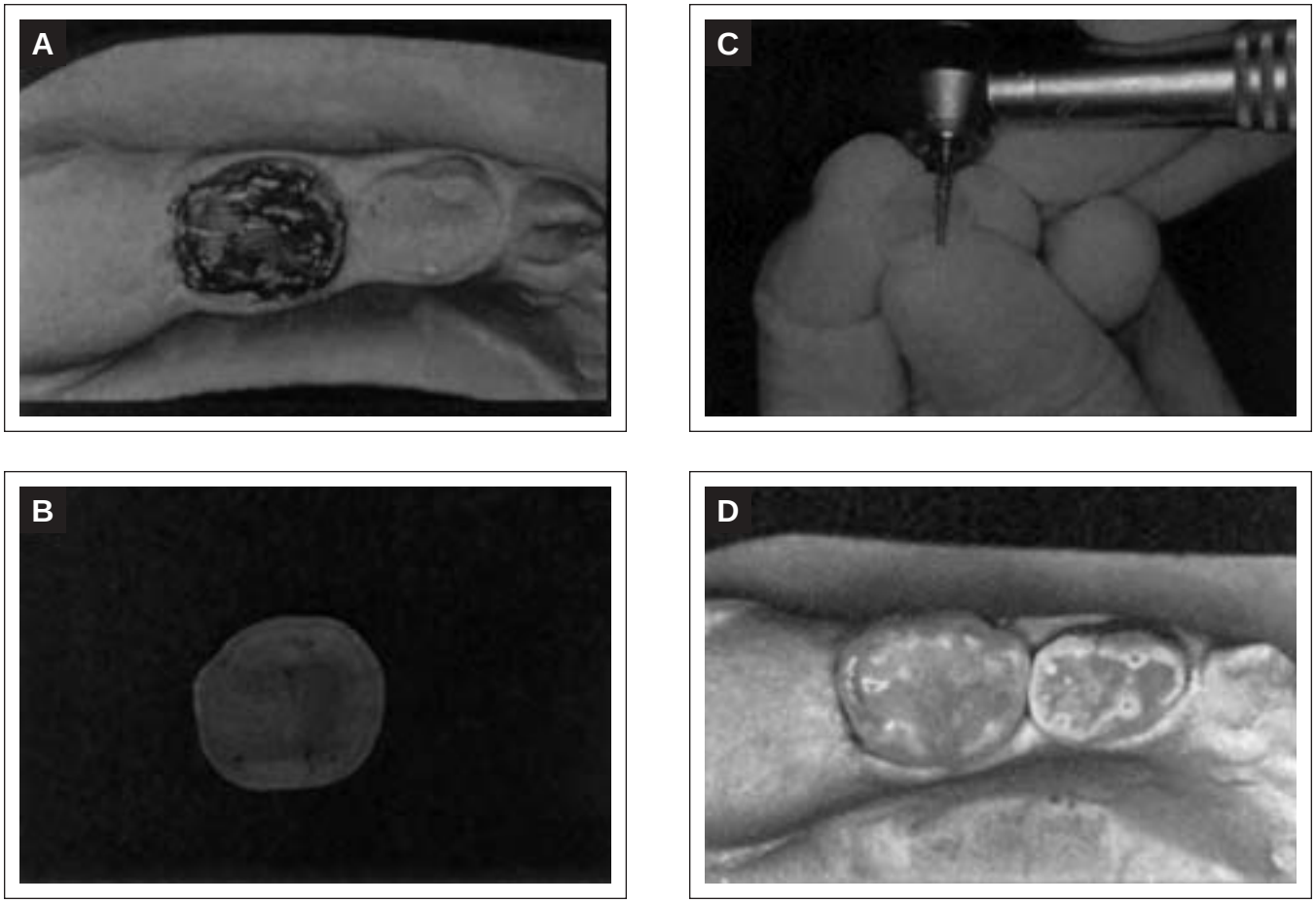

Figure 3. Performing the fragments preparation. **A.** preparation limits marked with graphite. **B.** the fragment with the points that were impairing good adaptation marked. **C.** high-speed preparation of the tooth fragment. **D.** satisfactory adaptation of the fragment to the model achieved.

undergraduate students,[2] although some authors consider that the previously preparation of the fragment could reduce the length of each appointment.[5] Still, the technique requires rubber dam placement, which are not accomplished in some patients because of behavior control and the positioning of the fragment in the site of bonding requires very careful manipulation, even with the use of gutta-percha sticks.

In this case, a dual cured lutting agent was used, as suggested by other authors.[5,9,10] However, a comparison of fracture resistance in primary teeth restored with different bonding techniques showed that combination of an adhesive followed by composite was more efficient in bonding of primary tooth fragments when compared to dual-cured composite cements.[14] The use of very thin fragments, where all the dentin is removed lowers the fracture resistance of bonded fragments. In this case, the use of composite resins for bonding should increase this resistance by acting as a support for enamel.

The refusal of some parents in accepting the use of a tooth of unknown origin has been pointed out also as a technique difficulty.[5] However, a faculty practice population survey showed that although many parents are favorable to donation of organs, very few of them know the existence of banks for tooth tissues and only few of them were not willing to accept that their children receive restorations performed with tooth fragments.[15]

In the present case, the parents did not object to using teeth from a bank. Still, in spite of being young, the child showed great satisfaction of receiving the teeth. According to the mother, the child used to hide her face during smiling, and, after teeth placement she liked to show their friends the restored teeth.

The best method for extracted tooth sterilization has not yet been defined. Humid steam vapor has been the more frequent technique used in performing biological restorations in clinical practice[5,9,10] and the most recommended.[16,17,18] It has already been verified by means of microbiological culturing and scanning electron microscopy that humid steam vapor sterilization of extracted teeth is a safe method of elimination of microorganisms and does not interfere with fragments bonding.[19] Literature still suggests other forms of sterilization as ethylene oxide gas[20] and gama radiation.[21]

This report stresses that aesthetic appearance may be a very important factor, even to small children and should be taken into account during oral rehabilitation. Besides improvement in psychological conditions and

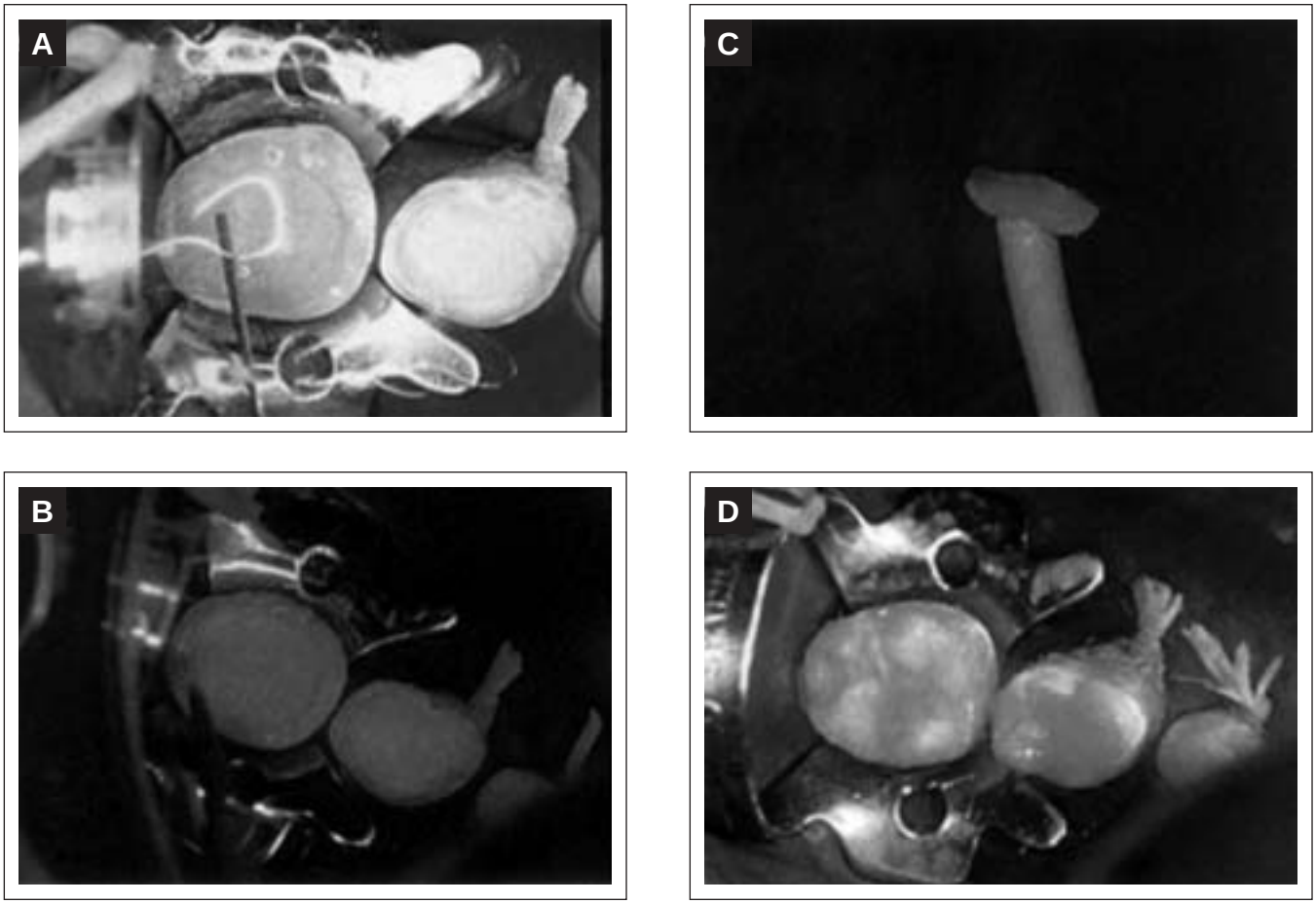

Figure 4. Sequence of bonding procedures. **A.** teeth and fragment acid etching. **B.** adhesive application. **C.** Placement of the fragment filled with the dual cured cement with the aid of a gutta-percha stick. **D.** final aspect of the bonded fragment.

social integration, the great change in oral hygiene habits and diet were striking. Immediate suppression of bottle-feeding, and healthy gingival tissues show that home care has been performed daily.

The reported observations demonstrated that biological restorations can be considered as an alternative for oral rehabilitation of some children. However, factors as time spent on the dental chair, costs, possible needs for repair and acceptance by the patient and guardians should be considered when planning restorative treatment for severely destroyed teeth using the biological restorations.

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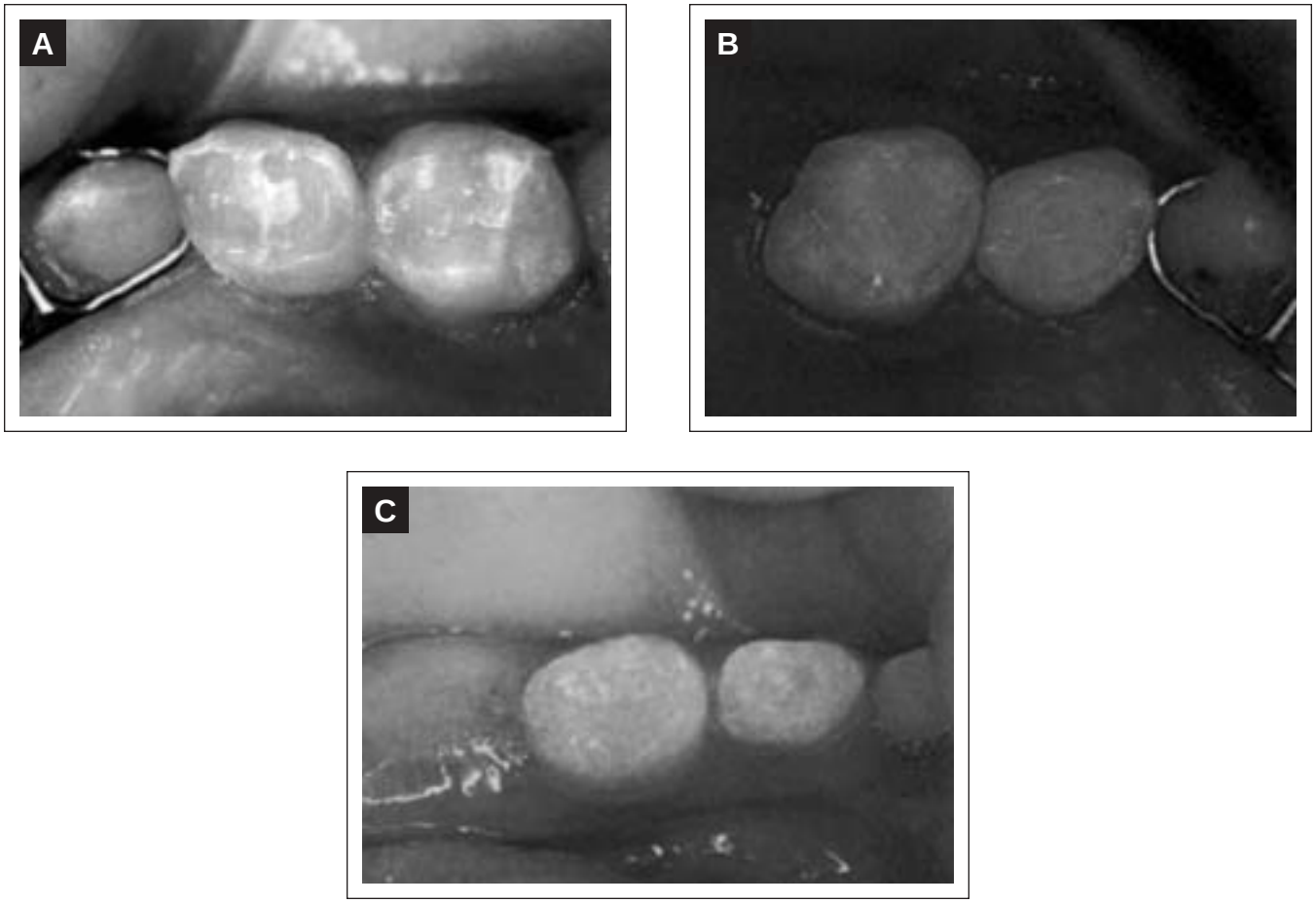

Figure 5. Final aspects of each quadrant. **A.** 55 and 54, **B.** 64 and 65, **C.** 74 and 75.

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