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Clinical Technique/Case Report

Mini Fiberglass Post for Ankylosed Tooth Reconstruction: A Clinical Technique

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Clinical Relevance

Ankylosed posterior teeth impede tooth stability in the arch. The literature does not offer evidence regarding the predictability of ankylosed tooth restorations. Additional retention through mini fiberglass posts for composites may be indicated to improve the long-term prognosis.

SUMMARY

It was possible to restore the shape and function of a severely ankylosed tooth by fabricating a ceramic crown for placement on a resin reconstruction supported by mini fiberglass posts. By increasing the retention of the morphological reconstruction for the future support of indirect restorations, cementable intradentinal fiberglass posts enhance the longevity of these restorations. Ultimately, all proposals that seek to improve the long-term prognosis of restorations on ankylosed teeth, especially severely impacted ones, are of extreme clinical relevance.

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INTRODUCTION

Dental ankylosis is caused by intimate contact between the root cementum and the alveolar bone as a result of the absence of the periodontal ligament between these tissues. This anomaly prevents the affected tooth from erupting and thus serving its functional role within the mouth.[1-4]

The restorative planning relative to ankylosed teeth is determined mainly by the patient's age, the remnant's degree of infraocclusion, and the relationship between the remnant and the alveolar ridge.[3,4]

Full crown reconstruction with direct composite resin is commonly used to restore the shape and consequently the function of ankylosed deciduous teeth. For permanent teeth, core build-up with composite resin aims to assist the retention of indirect restorations.[5,6] However, the literature does not offer evidence regarding the predictability of ankylosed tooth restorations.[7] Thus, it is prudent to consider the requirements of each case, which will influence the choice of restorative technique and indicate additional means of retention.[8]

The objective of this work was to review the clinical technique regarding the predictability of ankylosed tooth restorations and to describe the core build-up technique retained by mini fiberglass posts (MFPs) for composites in posterior teeth.

CLINICAL TECHNIQUE

Patient LKBL was an 18-year-old male in good general health. His first mandibular right molar (tooth 30) was affected by severe dental ankylosis. The diagnosis of severe ankylosis was determined through clinical and radiographic examinations. The patient also had a cross-bite and a posterior open bite on the same side as the ankylosed tooth (Figure 1A). The patient was under orthodontic treatment, which was partially interrupted to enable the reconstruction of tooth 30 through restorative techniques because it could not be reestablished through orthodontic treatment. A provisional restoration was initially requested so that the orthodontic treatment could be completed, after which a ceramic crown would be placed. The occlusal surface of the tooth was flush with the gingival tissue (Figure 1B). Periapical radiographic examination showed that the mesial uppermost portion of the crown was below the bone crest. The right mandibular premolar (tooth 29) was slightly distalized (Figure 1C).

The treatment plan comprised surgical crown lengthening, transsurgical morphological restoration with composite resin supported by MFPs, and

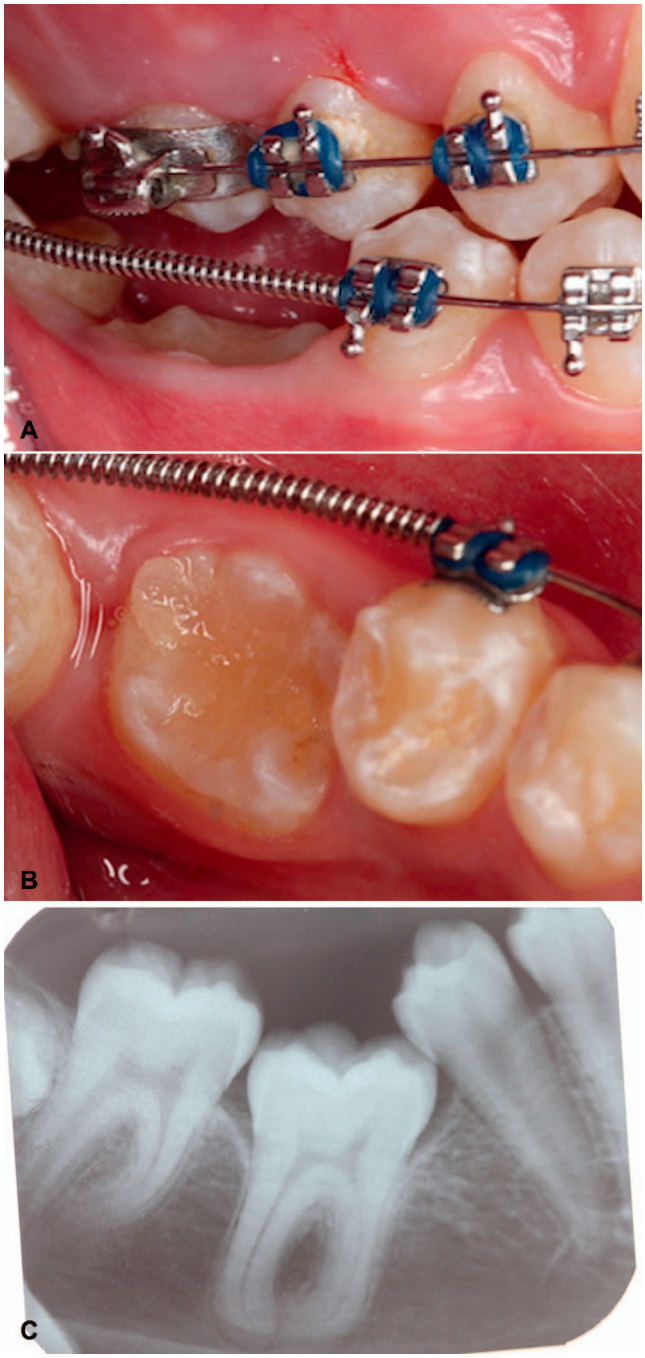

Figure 1. *(A) Initial condition: Side view of the first right lower molar flush with the upper margin of the gingival sulcus. (B) Initial condition: Occlusal view of ankylosed right mandibular first molar (severe ankylosis). (C) X-ray image of the right mandibular first molar flush with the mesial bone crest.*

provisional crown fabrication using the direct technique.

Once the occlusal level of the remnant relative to the bone crest was assessed, a partial periodontal flap was raised, and 3 mm of the mesial bone crest

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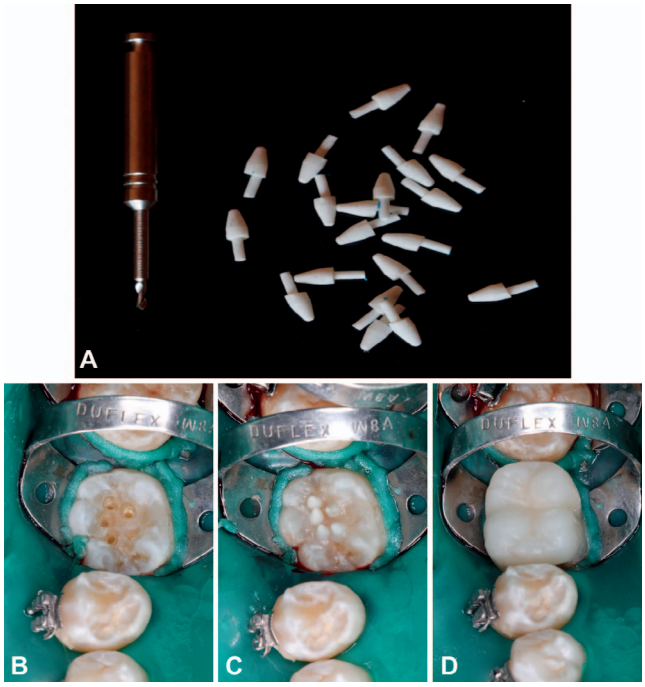

Figure 2. *(A) Mini fiberglass posts for composites and spiral bur for preparation. (B) Preparations performed in correspondence with each of the five cusps. (C) Cemented mini posts. (D) Reconstructed clinical crown using composite resin.*

was removed to restore the biological widths and to favor the absolute isolation of the operative field. After absolute isolation, a spiral bur that was included in the fiberglass post kit (Figure 2A) was used to make five perforations spaced at least 1 mm apart in the central portion of tooth 30, corresponding to its cusps (Figure 2B). A 0.65-mm–diameter and 2.0-mm–deep pin-hole parallel to the outer surface of the tooth was placed in the dentin 0.5 mm from the enamel/dentin junction with a twist drill (Angelus) in a slow-speed handpiece. An MFP was placed into the pin hole to evaluate adequate inclination and occlusal clearance. The portion of the MFP inserted into the dental substrate was 0.63 mm in diameter and 2.0 mm in length, and the coronal aspect had a conical shape of 1.3 mm in diameter at the base of the cone and 0.65 mm in diameter at the tip of the cone and was 2.5 mm in length. Taking into account the active length of the intradentinal portion of the pin, one can expect a practically limited preparation to the enamel substrate, thereby ensuring a safe distance from the pulp chamber.

The posts had been previously etched for one minute with 37% phosphoric acid (FGM, Joinville, SC, Brazil), washed abundantly with a water/air jet, and dried vigorously. Subsequently, a silane agent (Silano-Angelus, Londrina, PR, Brazil) was applied. After silanization, a hot air jet was used to fully dry the silane and to apply an adhesive layer (Adper™ Single Bond 2, 3M ESPE, St Paul, MN, USA). The enamel of the entire tooth was etched with 37% phosphoric acid (FGM) for 30 seconds and then washed and dried vigorously. As a result of the difficulty of hybridizing the prepared hole for post insertion, self-adhesive resin cement (Rely-X Unicem, 3M ESPE) was used. This cement was mechanically activated in a suitable device (Ultramat, SDI, Victoria, Australia), as recommended by the manufacturer. Then the cementing agent was introduced into the holes using an exploratory probe, and the intradentinal portion of the MFPs was simultaneously embedded in the cementing agent. One by one, the MFPs were placed into the holes using forceps specially designed for this task. Excess cement was removed using a microbrush (Cavibrush Fine, FGM), and photoactivation (Demetron Optilux 500; Kerr GmbH, Karlsruhe, Germany) was performed by focusing the light perpendicular to the long axis of the tooth (Figure 2C). After the chemical setting time had passed, the adhesive procedures were started in the enamel and in the extradental portion of the post.

Two adhesive layers (Adper Single Bond 2, 3M ESPE) were applied to the entire occlusal surface, and the last layer was light-cured for 20 seconds. Soon after, small increments of light-curing composite resin (Z350 XT, 3M ESPE) were inserted between the posts and into the occlusal portion until fine anatomy was obtained. Additional light-curing was performed for 60 seconds on all sides of the composite resin crown (Figure 2D). The rubber dam was removed, and the flap was repositioned and sutured (Figure 3). After 10 postoperative days, the sutures were removed.

At 120 days after surgery, the tooth was prepared to receive a full crown (diamond burs 3216 and 4138, KG Sorensen). A 2-mm–thick bevel was performed throughout the cervical extension at the gingival level, and the bevel was on the tooth structure. The occlusal reduction considered the crown height of adjacent teeth due to the open bite on this side. All internal angles were rounded. Finishing procedures were performed with a multilaminated bur (9642 Jet, Labordental, São Paulo, SP, Brazil), and the margins were finished with manual cutting instruments (Figure 4). The characteristics of the cavity preparation were in accordance with the prerequisites for preparation for CAD/CAM restoration.

Next, the color of the acrylic resin was chosen. Using the casting technique, an immediate provi-

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Figure 3. *Completed transsurgical reconstruction.*
Figure 4. *Occlusal view of the preparation for full crown.*

sional restoration was fabricated. The restoration was used to keep the gingival margins in position, to protect the exposed dentin in the preparation margins, to maintain the position of the adjacent teeth, and to restore dental function. Accommodation for tooth wear was checked by measuring the thickness of the provisional restoration using a thickness gauge. Subsequently, the provisional restoration was cemented.

The patient resumed orthodontic therapy and, as the uprighting of the tooth 29 occurred, relapse measures of the temporary restoration were performed in order to prevent food impaction and to favor local hygiene.

After 12 months, when the fixed orthodontic appliance was removed, the patient returned so that the ceramic restoration could be fabricated. The provisional restoration was removed, and the cavity was cleaned and scanned using a Trios 3 scanner (3Shape; Copenhague, Denmark). At this time, the adjacent and opposing teeth were also digitized, and the upper and lower virtual models were related in maximal habitual intercuspation (Figure 5A). Based on the virtual models, the preparation margins were outlined, and the restoration was designed (Figure 5B) using Dental System software (3Shape). After the design was completed, color analysis and mapping were performed (Figure 5C,D). The information was sent as an STL file for the fabrication of the crown. A DWX-4W milling unit (Roland; Japan) was used. The material of choice for this patient was the Emax A3HT block (Ivoclar Vivadent, Schaan, Liechtenstein).

Once the crown was available in its pre-crystalized stage (Figure 6), its margins and proximal and occlusal contacts were checked. A small refinement of the occlusal contacts was necessary, and then the crown was crystalized and painted to produce a finely detailed restoration (Figure 7).

Subsequently, the intaglio portion of the lithium disilicate ceramic restoration was etched using hydrofluoric acid for 20 seconds and then washed and dried vigorously. A layer of universal primer (Monobond Plus, Ivoclar Vivadent) was applied, air jet-dried, and light-cured for solvent volatilization, and a layer of adhesive (Adper™ Single Bond 2, 3M ESPE) was applied. The prepared cavity was cleaned using pumice paste and a polishing brush and then washed thoroughly and dried. The enamel margins were etched for 30 seconds with 37% phosphoric acid (FGM) and then washed and dried vigorously. Relative isolation of the operative field was performed, aided by high-power suction. The self-etching resin cement was activated according to the manufacturer's instructions (U-200, 3M ESPE) and placed inside the crown, and the crown was then positioned. Excess cement was removed using a brush, and the margins were light-cured for 60 seconds on each side. The restoration was then left alone for six minutes to allow the cement to chemically set. At the end of the cementation process, the minimum excess cement was removed using a no. 12 scalpel blade (Lamedid Solidor, Barueri, Sao Paulo, Brazil). A periapical long cone paralleling technique radiograph was taken to ensure that excess cement was completely removed and to visualize the final adaptation of the restoration (Figure 8). Finally, the patient was referred back to orthodontics to be fit with a retainer.

The restoration was completed, and the proper shape and esthetics were reestablished in terms of the periodontal tissues and occlusal principles. This ensured that dental function would be correct after

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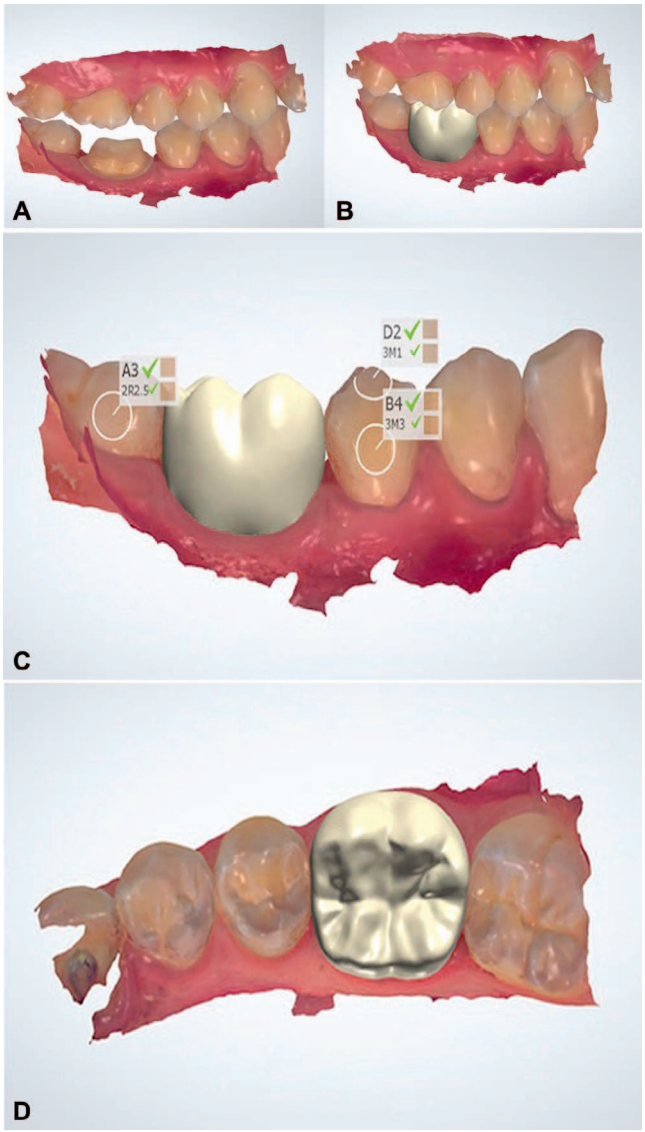

Figure 5. *(A) Sagittal view of the scanned preparation and occlusion relation. (B) Sagittal view of the crown design in position. (C) Sagittal view of the color mapping obtained after scanning and designing steps were completed. (D) Occlusal view of the final three-dimensional designed crown.*

the patient completed his orthodontic treatment. Longitudinal follow-up will be conducted to evaluate the advantages of using MFP, a novel additional retention, in posterior teeth.

DISCUSSION

Ankylosed posterior teeth impede tooth stability in the arch, which may manifest as the extrusion of the opposing tooth and the migration of adjacent teeth.[1,2,5-7] As a consequence, dental ankylosis leads to the rupture of the binomial, through which the form is responsible for the preservation of function

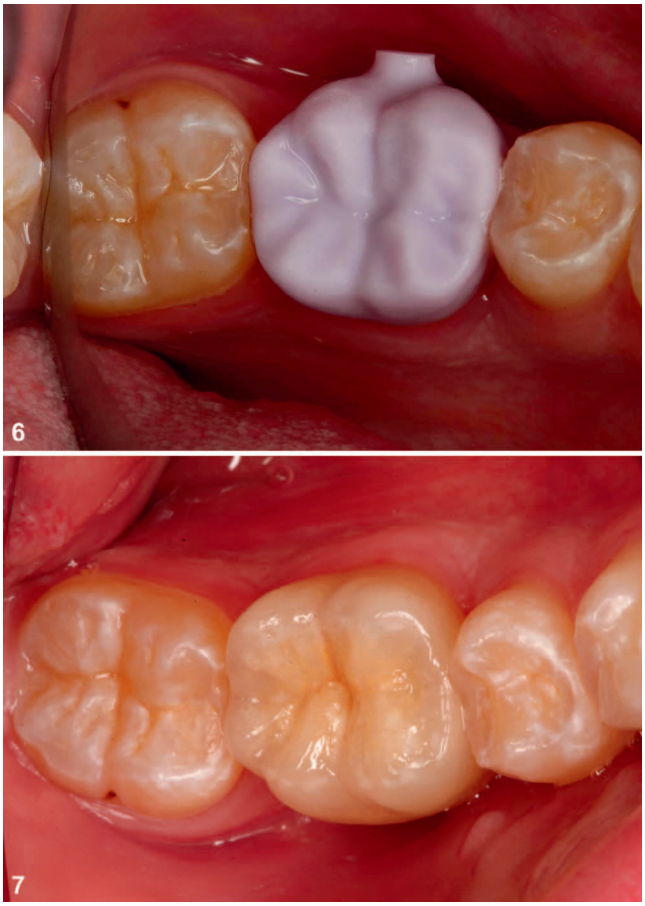

Figure 6. *Pre-crystalized crown after milling process.*
Figure 7. *Completed and cemented restoration*

and the function maintains the form.[9] Thus, it is necessary to propose a restorative therapy that can restore the crown anatomy and consequently the dental function. The earlier the patient is diagnosed and undergoes appropriate treatment, the greater the chances of reducing the complications associated with ankylosed teeth.[2-7,10]

Ideally, the restorative plan should be reconciled with orthodontic treatment and should consider the degree of infraocclusion of the tooth and the patient's age.[3,4] In addition, it should meet the main requirements for successful restorative therapy, such as periodontal health, function, and longevity of the restoration.

However, there are no studies offering long-term, predictable results for the longevity of restorations for ankylosed teeth. Thus, there is no guidance regarding the most effective form of restorative therapy. This fact was shown in 2010, when a Cochrane search confirmed that there were no randomized clinical trial data supporting a thera-

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Figure 8. *Interproximal X-ray of the restoration immediately after cementing.*

peutic approach for ankylosed teeth.[7] This gap in the literature can be verified to continue through the present.

Regarding proposals for the treatment of ankylosed permanent teeth, the literature advocates both conservative and extremely invasive procedures. The conservative proposals involve completely filling the crown portion with direct composite resins and the use of a direct composite resin core build-up to support a subsequent indirect ceramic restoration. The invasive proposals include exodontia and implants, surgical repositioning with previous luxation, and osteogenic distraction.[1-3,5-7,11]

The advantages of ceramic crowns supported by composite resin reconstructions are mainly related to the possibility of maintaining the natural tooth as a pillar, thereby transmitting physiological loads to the periodontal support and allowing the tooth's dimensions to be preserved. Ceramic crowns also offer the benefits of surface smoothness, color stability, high wear resistance, and biocompatibility.[12] However, in the case of ankylosed teeth, a support must be constructed under the crown.

From the biomechanical point of view, the dental lever system developed by lateral loads is more beneficial when the resistance arm is at least twice as large as the power arm.[13] Considering this fact, the restoration of ankylosed permanent teeth is quite favorable because it has a lever system in which the resistance arm contains the root and part of the anatomical crown. The power arm, however, needs to contain material that provides the long-term retention of the filler material. In addition, restorations of posterior teeth are subjected to a tensile load.[14] Thus, improving the retention of restorations in posterior teeth is essential for successful therapy. According to Binus and others,[8] the needs presented will influence the selection of the restorative technique. Additional retention may be indicated to improve the long-term prognosis of the selected therapy.[8,15-18]

Restorative proposals that aim to improve the quality and longevity of ankylosed tooth restorations are relevant given the lack of scientific evidence. Thus, morphological reconstructions supported by additional retention, such as intradentinal posts, especially for ankylosed posterior teeth, can be planned with the aim of improving the longevity of the restoration. MFPs have recently been introduced as an alternative to threaded intradentinal metal pins.[15,16] Their greatest advantages include their low cost, their use of a simplified technique, their noninfluence on the final esthetics of the restoration for anterior teeth, for example, and the minimization of the tension imposed on dentin that they offer compared with the use of threaded intradentinal posts.[15]

To improve the retention of an intradentinal post, sufficient interocclusal and vestibular-lingual space to accommodate it inside the reconstruction material must be present. Because the present clinical case was a morphological reconstruction that was subject to occlusal wear, it was necessary to maintain the thickness of the composite resin to enable the preparation of the all-ceramic crown; this was possible because of the short height of the MFPs. In the case of direct composite resin restorations that will not require future work, which are very common in cases of ankylosis of deciduous teeth, threaded intradentinal metal pins may also be indicated. These pins have a long clinical history of success and are still used today.[18] Additional retention can be created using pins and grooves;[17,18] however, they incur greater wear of the healthy dental structure compared with the technique described herein.

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Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Federal University of Minas Gerais, Brazil.

Conflict of Interest

The authors of this manuscript certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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