Revista Odontológica Mexicana
Órgano Oficial de la Facultad de Odontología UNAM

Clinical case

Minimally Invasive Restoration of Interdental Spaces in a Young Patient

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Received: October 2022
Accepted: February 2024

Cite as:
Figueroa Hidalgo IA, Castañeda Rodríguez G, Rodríguez-Chávez JA, Curiel-González R, Magaña-Curiel K, Montaño Santos I, *et al*. Restauración mínimamente invasiva de espacios interdentales en una paciente joven [Minimally Invasive Restoration of Interdental Spaces in a Young Patient]. *Rev Odont Mex*. 2024; 28(2): 11-17. DOI: 10.22201/fo.1870199xp.2024.28.2.83773

ABSTRACT

Introduction: The shape, position, colour of the teeth and their relationship with the gingival tissues determine the harmony of the smile. The flowable resin injection technique in combination with occlusal and aesthetic prosthetic concepts offers a conservative approach to restoring teeth and improving their proportion, shape and contour. Using a silicone key, a diagnostic wax-up can be transferred to the clinical situation in a predictable manner, is repairable, and has a reported success rate of 3 to 7 years. Furthermore, compared to conventional ceramic veneer procedures, the injected resin technique allows for minimal wear of the tooth structure, is considerably more economical and requires less time. **Objective:** To describe a treatment followed to close interdental spaces with a minimally invasive technique in the anterior maxillary sector (13-23). **Case presentation:** A 16-year-old female patient attended the Prosthodontics Specialty clinic referred by the Orthodontics Specialty to close interdental spaces. Unsatisfactory aesthetics, wide interdental spaces, high smile and caries were identified. The periodontal diagnosis was altered passive eruption and maxillary exostosis. The treatment was divided into three phases: First phase, Hygienic, coronal scraping was performed in the 4 quadrants. Second phase, Surgical, the crown lengthening of teeth 16 to 26 was performed and the bone exostosis was removed from them. Third phase, Prosthetics, 10 veneers were made using the injected resin technique. **Conclusions:** Multidisciplinary management is essential for a good diagnosis and execution of appropriate treatment plans. In this case, the interdental spaces were closed with minimally invasive restorations with adequate contours and proportions and gingival exposure was reduced through surgery.

Keywords: injected resins, minimally invasive, altered passive eruption, aesthetic restorations, anterior sector.

INTRODUCTION

We currently observe a boom in the aesthetic demands of patients who come to the clinic every day. It is important to mention that the shape, position, colour of the teeth and their relationship with the gingival tissues determine the harmony of a smile. We call a gummy smile or high smile, one that completely shows the teeth and a band of gum[1] and it can be caused by altered passive eruption, dentoalveolar extrusion, an excess of maxillary verticality and short or hyperactive upper lip muscles[2]. Aesthetic crown lengthening is a treatment for gummy smile in which the extension of the clinical crown is increased to restore dentogingival relationships, with the aim of improving functional and aesthetic aspects. The treatment remodels the periodontium, eliminates excessive gum exposure and provides correct dimensions to the teeth[3].

In cases where we find intrinsic discolorations, fractures or incisal wear, morphology outside normal or unaesthetic limits, malposition, diastemas or tremas, and in which orthodontics alone cannot improve aesthetics, we can consider the use of veneers as a complement to a multidisciplinary treatment[4].

Over time, researchers and manufacturers of dental materials have aimed to develop new materials with better aesthetic characteristics and superior mechanical properties. An example of this is composite resins with smaller, more spherical particles, which are inherently susceptible to high gloss when polished, retain their polish for longer periods, and are more

resistant to wear[5]. Compared to conventional ceramic veneer procedures, the injected resin technique allows for minimal wear of tooth structure, is considerably more economical and requires less clinical time[6]. This technique, in combination with occlusal and aesthetic prosthetic concepts, offers a different approach to restoring teeth and improving their proportion, shape and contour. Furthermore, it predictably transports a diagnostic wax-up, requires no dental preparation, can be used to expand the range of therapeutic possibilities, is repairable, and has a reported success rate of 3 to 7 years[7].

The following is the case of a patient diagnosed with altered passive eruption and maxillary exostosis, unsatisfactory aesthetics, wide interdental spaces and a high smile. The treatment was divided into three phases: the first phase, Hygienic, the second phase, Surgical, with crown lengthening and the third phase, Prosthetic, with veneers using the injected resin technique.

CLINICAL CASE PRESENTATION

A 16-year-old female patient who attended the Prosthodontics Specialty Clinic after being referred by the Orthodontics Specialty to close interdental spaces. She presented a mesocephalic facial biotype with a straight profile, thick lips, interpupillary line slightly ascending towards the right side with respect to the intercommissural line, and symmetrical facial thirds. The nasolabial angle was decreased (95°), the lower lip was in front of the E line and the upper lip was behind it. At rest, the upper tooth was exposed by 5 mm. The length of the upper lip at rest was 20 mm and at maximum smile 14 mm. The dental midline was slightly deviated to the left with respect to the facial midline. The patient presented a high smile, showing 10 teeth (absence of first premolars) (Figure 1. A), the left buccal corridor was wider than the right one, the incisal edges did not match the curvature of the lower lip.

Intraoral analysis showed ovoid and continuous maxillary and mandibular arches. Also, interdental spaces between teeth 13 and 12, 12 and 11, 21 and 22, and 22 and 23, orthodontic appliances (Figure 1. B) in both arches, amalgam restorations on teeth 36, 37 and 47 and carious lesions on teeth 35, 46 and 45. The patient presented a band of keratinized gingiva ranging from 4 to 6 mm, slight inflammation and bleeding on probing. Radiographically, the continuity of the lamina dura (Figure 1. C) and the included maxillary and mandibular third molars could be observed. She presented a Class I Molar and Canine relationship on the right and left sides and a 3 mm overbite and overjet.

The periodontal diagnosis was plaque-associated gingivitis of multifactorial aetiology, altered passive eruption, and maxillary exostosis. Prosthetic assessment showed unsatisfactory aesthetics, wide interdental spaces, a high smile and caries. Therefore, our treatment objectives were to close interdental spaces with a minimally invasive technique in the anterior maxillary sector (teeth 13-23). In addition, functionally providing the patient with restorations with characteristics of an organic occlusion, as well as instructing her in hygiene techniques to maintain good oral health, prevent and eliminate factors contributing to gingivitis associated with dental plaque and finally, to achieve an aesthetically favourable smile, harmonizing dental anatomy, dental contours and proportions.

The orthodontic appliances were then removed (Figure 1. C). The treatment plan was divided into three phases. In the first phase, Hygienic, coronal scraping was performed in the four quadrants. In the second phase, Surgical, crown lengthening of teeth 16 to 26 was performed and the bone exostosis was removed from them. Finally, in the third phase, Prosthetic, 10 veneers were made using the fluid resin injection technique.

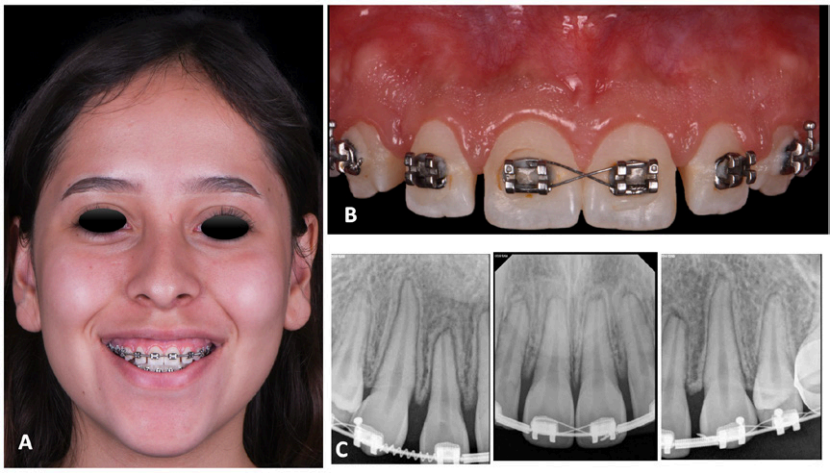

Figure 1. Initial photographs and radiographs. A. Facial photograph of a smile. B. Intraoral photograph with orthodontic appliances, where spaces between the teeth can be seen. C. Dentoalveolar radiographs that display the continuity of the lamina dura.

Diagnostic impressions were taken with polyvinyl siloxane (PVS) (3M™ Imprint II™, 3M ESPE Deutschland GmbH, Germany) and a record was obtained with an articulator (Artex® CR, Amann Girrbach AG, Mäder, Austria), to mount the models, a record was taken with extra-hard wax (Truwax®, Healthium Medtech Ltd., Bengaluru, India) and Aluwax (Aluwax™, Aluwax Dental Products Co., Michigan, USA). The upper model was first mounted on the transfer table and then both models were articulated. The models were duplicated to have working models.

A first wax-up was made for the production of the surgical guide. Surgery was performed to lengthen the crown of teeth 13 to 23 and a second intervention to lengthen teeth 15, 16, 25 and 26 and remove exostoses. Once the healing time was over, impressions were taken with PVS and a second waxing was performed (Figure 2. A). A display model was made and tried in the patient's mouth to show the patient the design of the final restorations with bisacrylic resin, shade A1 (3M™ Protemp™ 4, 3M Espe Deutschland GmbH, Germany). A key was made with condensation silicone (Zetalabor, Zhermack SpA, Rovigo, Italy) on the waxed model and a 60-gauge rigid acetate was placed on it, in which transparent PVS (Transil® F, Ivoclar Vivadent AG, Liechtenstein) was placed to form the guide for the resins to be injected (Figure 2. B). Tooth surfaces were conditioned with pumice as an alternative to intraoral wet sandblasting, which is considered the ideal conditioner to prepare the tooth surface prior to dental bonding protocols (Figure 3A).

Subsequently, a cotton swab moistened with 5% sodium hypochlorite was rubbed on the enamel surface for 1 minute to deproteinize the tissue and the tooth-by-tooth bonding protocol was followed by placing phosphoric acid for 20 seconds (s) (Figure 3. B). It was washed, dried and adhesive (3M™ Single Bond Universal Adhesive, 3M Espe Deutschland GmbH, Germany) was placed by rubbing it for 20 s (Figure 3. C), volatilised with air from the triple syringe and light-cured for 20 s (1,200 mw, 3M™ Elipar™ DeepCure-S LED Curing Light, 3M Espe Deutschland GmbH, Germany). The silicone guide was placed (Figure 3. D), fluid resin, shade A1 (3M™ Filtek™ Z350 XT Universal Restorative, 3M Espe Deutschland GmbH, Germany) was injected (Figure 3. E) and light-cured for 40 s. After the silicone guide was removed, a layer of glycerin gel (K-Y® Gel Lubricant, Johnson & Johnson Services, Inc., New Jersey, USA) was placed on the surface of the resin and polymerized again for 40 s in order to eliminate the polymerization-inhibited layer

due to the presence of oxygen. Excess material was carefully removed with a No. 12 scalpel blade and extra-fine gauge interproximal sandpaper strips (OptiStrip™, Kerr Corporation, Bioggio, Switzerland). Discs and rubbers (OptiDisc™, Kerr Corporation, Bioggio, Switzerland) were used at low speed with diamond paste (Ultradent™ Diamond Polish Mint, Ultradent Products Inc., Utah, USA) (Figure 3. F) to polish the restorations (Figure 3. G).

Among the results, the patient's smile was improved by reducing gingival exposure (Figure 4. A) through periodontal surgery, a favourable gingival architecture was obtained, and the contact points and surfaces were restored for adequate papilla support. Also, the current curvature of the incisal edges coincides with the curvature of the lower lip, and the interdental spaces were closed with adequate dental contours and proportions (Figure 4. B-C). The anterior guide was maintained correctly, achieving immediate and functional canine guidance. The restorations are well sealed and polished, promoting periodontal health and avoiding secondary caries.

DISCUSSION

As Alothman & Bamasoud[4] mention, achieving the patient's aesthetic satisfaction is a complex process since it is a subjective aspect. However, some factors can play an important role such as

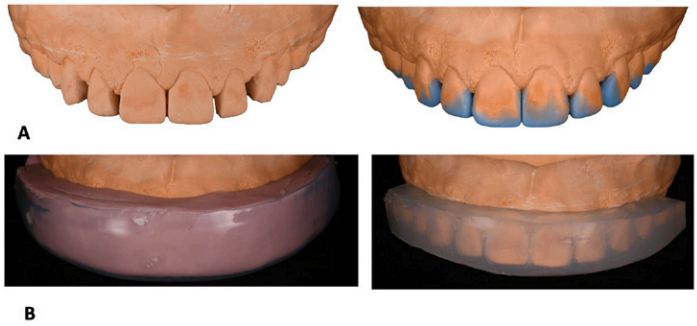

Figure 2. Silicone guide preparation. A. Model and diagnostic wax-up. B. Silicone guide preparation process.

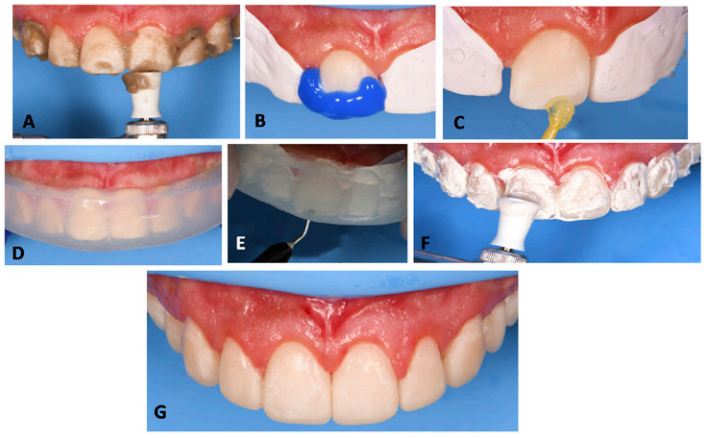

Figure 3. Fluid resin injection process. A. Conditioning of tooth surfaces. B. Application of etching acid. C. Application of adhesive. D. Silicone matrix. E. Fluid resin injection. F. Restorations polishing. G. Final restorations.

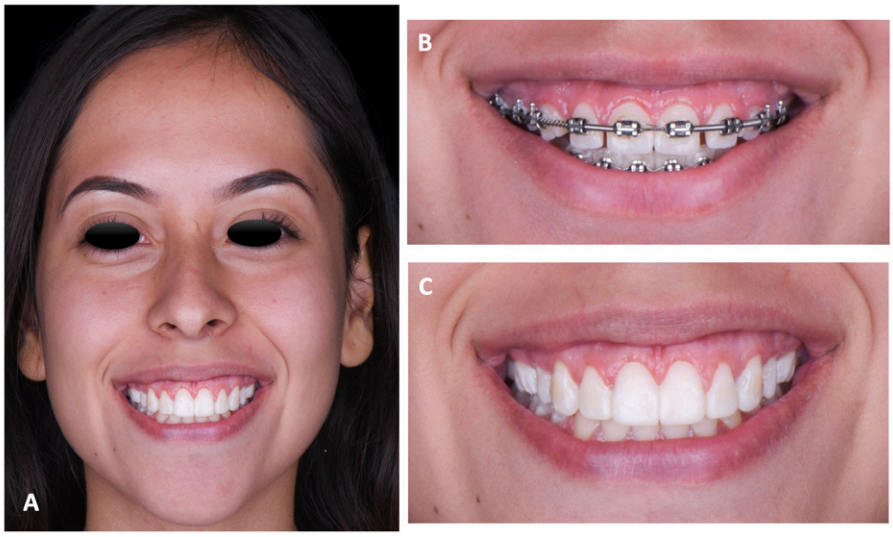

Figure 4. Final photographs. A. Facial photograph of smile. B. Initial smile. C. Final smile.

the durability of the final result, the amount of tooth preparation required, the type of material used and the cost of the treatment. The patient demanded high aesthetics and presented a case in which multidisciplinary interventions were necessary to achieve pleasing results.

Ricketts[8] points out that one of the main objectives of orthodontic treatment is the balance and harmony of facial aesthetics. The word balance implies uniformity or proper proportion of parts or elements. Harmony denotes a union or a smoothness, or that which is pleasant. To achieve this, there are techniques for rearranging teeth, though, sometimes the placement of appliances will not be sufficient to meet aesthetic requirements and a multidisciplinary treatment with other areas such as prosthodontics and/or periodontics will be necessary[8]. In this case, the interdental spaces were closed with adequate contours and proportions.

Today, aesthetic restorative dentistry offers ultra-conservative options with minimal removal of healthy tooth structure for indirect procedure treatments. Direct composite restorations are frequently used for augmentation procedures in the anterior sector[9]. In this patient, no dental wear was performed; the teeth were simply conditioned to receive the resins, so the treatment was minimally invasive.

Flowable composite resins were introduced to the market in 1996. They have low viscosity, have a filling of 37 to 53% compared to conventional resins that have 50 to 70%. They are indicated as pit sealants, provisionalisation, splinting, improvement of internal adaptation, intraoral repair of fractured ceramics, staple stabilization, resin repair, among others. The injection technique predictably delivers a diagnostic wax-up, requires no dental preparation, can be used for a variety of treatments, is a reversible treatment, is repairable, and has a reported success rate of 3 to 7 years. The disadvantages include colour changes, wear and shorter duration compared to other direct restorations[10].

The first treatment alternative is ceramic veneers, which, as Gresnigt *et al.* mention, are significantly better than composite restorations based on their long-term success and survival[11]. In addition, ceramic restorations have less wear compared to resin and proven colour stability of up to 10 years[12]. As a second alternative, there are direct resin veneers, which require more clinical work time while maintaining the disadvantages of composite compared to ceramic. Ceramic fragments, unlike conventional ceramic veneers, require a minimal reduction of tooth

structure, just like resin restorations. Yet, they require greater manual skill on behalf of the specialist, as well as the dental technician to achieve blending with the substrate[9]. Finally, in the present clinical case, injected resins were chosen in order to achieve a minimally invasive approach due to the patient's age as well as a lower cost.

CONCLUSIONS

Multidisciplinary management is essential for a good diagnosis and implementation of appropriate treatment plans. The injected resin technique incorporates nanohybrid fluid composite materials with improved physical and optical properties, and is a new treatment modality for minimally invasive rehabilitations. The combination of traditional concepts of prosthodontics and occlusion with the injection technique facilitates aesthetically and functionally favourable results. Clinical studies are needed to evaluate its long-term performance.

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