

An Interdisciplinary Approach for Diastema Closure In the Anterior Maxilla: A Clinical Report

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Abstract

Achieving a satisfactory anterior esthetic outcome is a considerable challenge for most dentists. Multiple interdisciplinary approaches are necessary to resolve esthetic defects, especially in cases of improper tooth alignment and excessive space between anterior teeth. This case report describes an interdisciplinary approach used for a 66-year-old male with diastema and peg-shaped lateral incisors. The interdisciplinary treatments included orthodontic and prosthodontic treatments. All ceramic crowns and porcelain laminate veneers were successfully applied to correct esthetic problems and achieve improved esthetic and functional outcomes.

Keywords: diastema, all ceramic crowns, porcelain laminate veneer

Introduction

The increasing demand for esthetic restorations has been met around the world in recent years. However, the esthetic appearances of cosmetic restorations are usually compromised by many potential problems, such as a diastema in the midline region, asymmetry of tooth arrangement and proportion, asymmetry of the gingival level and tooth discoloration. In such instances, an interdisciplinary approach including periodontic, endodontic, orthodontic, and prosthodontic treatments is necessary to evaluate and solve esthetic problems.¹⁻³

The presence of a midline diastema usually distorts a pleasing smile. A lot of treatment options have been proposed to close the space between maxillary anterior teeth.³⁻⁵ A careful diagnosis of the causal element is important in determining the appropriate treatment plan. However, the etiology of diastema is complex and multifactorial. Several etiological factors have been proposed as the causes of diastema, including periodontal attachment loss, pressure from the inflamed tissue, occlusal factors such as trauma from occlusion, oral habits (such as bruxism, mouth breathing, tongue thrusting, sucking habits, pipe smoking, and playing of wind instruments), abnormal labial frenum, non-replacement of missing teeth, gingival overgrowth, and iatrogenic factors.⁴⁻⁶ In addition, a peg-shaped lateral incisor has also been regarded as a potential cause of diastema due to the distal movement of the central incisor.⁷



Fig. 1 Intra-oral frontal view showed large diastema between maxillary central incisors and peg-shaped maxillary lateral incisors.



Fig. 2 Pretreatment maxillary (a) and mandibular (b) occlusal view.

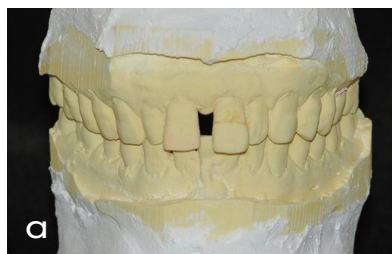


Fig. 3 Frontal view (a) and lateral view (b) of pretreatment mounted casts.

In some instances, orthodontic treatment can improve esthetic problems and the patient's satisfaction by correcting anterior open bite and closing the diastema. However, when dentoalveolar and Bolton discrepancies are detected, orthodontic treatment alone is not sufficient to obtain ideal proximal contacts with satisfactory vertical and horizontal overlaps.^{8,9} In such instances, the orthodontic treatment can be used to redistribute the adequate spaces between the maxillary anterior teeth prior to the restorative treatment. The literature has demonstrated that direct composite resin restorations, porcelain laminate veneers and crowns are good treatment options for correcting anterior diastema.^{5,9} Therefore, the purpose of this clinical case report was to present the interdisciplinary management (including orthodontic and prosthodontic treatment) of a patient who exhibits maxillary anterior diastema and peg laterals.

Case Report

A 66-year-old male came to Fung Chai Dental Clinic (Taichung, Taiwan) for restorative treatment. His chief complaint was tooth spacing and improper appearance of the maxillary anterior teeth. No major systemic diseases or drug allergies were noted. Extra-oral examination indicated the 3 mm of tooth display and diastema between maxillary central incisors at rest. Intraoral examination revealed normal dentition with mild gingival recession and cervical abrasion on the buccal side of teeth. There was approximately 2.5 mm spacing between the maxillary central incisors (Fig. 1). The labial flaring of maxillary central incisors,

small peg-shaped maxillary lateral incisors, and occlusal enamel erosion over posterior teeth were all presented (Fig. 2). During the protrusive movement, the maxillary central incisors contacted evenly with the mandibular incisors. However, in the edge-to-edge position, only the left maxillary central incisor contacted the mandibular incisors. Tooth 21 showed discoloration and negative pulp vitality. The regular gingival zenith and thick gingival biotype were noted. In addition, the vertical overlap and horizontal overlap were 3 mm and 7 mm respectively according to the measurement on the study cast (Fig. 3). The mesio-distal widths of four maxillary incisors from tooth 12 to 22 were 5.9, 9.2, 9.0, and 5.8 mm respectively. The diagnosis of this case included diastema, peg-shaped maxillary lateral incisor, and labial flaring of maxillary central incisors.

After communication and discussion with this patient, the definitive treatment plan included closing the space between maxillary central incisors and aligning maxillary incisors to proper position with orthodontic treatment. Furthermore, full ceramic crowns were recommended to restore the maxillary central incisors and laminates for lateral incisors. The preliminary treatment included oral hygiene instructions, caries control, non-surgical periodontal therapy, root canal treatment of tooth 21, and orthodontic treatment for 6 months. Orthodontic treatment included alignment of the maxillary and mandibular dental arch; correction of excessive horizontal overlap; and creation of adequate space for further prosthodontic restorations (Fig. 4). Before removal of brackets, tooth proportion and space distribu-

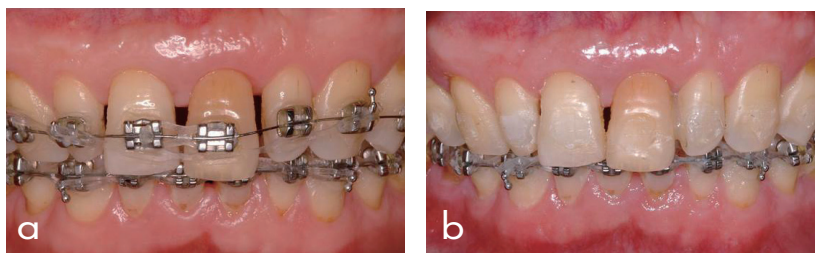


Fig 4. (a) Frontal view before the completion of orthodontic treatment. Diastema between maxillary central incisors was closed and space was re-distributed. (b) Frontal view after the completion of orthodontic treatment at the maxillary arch.

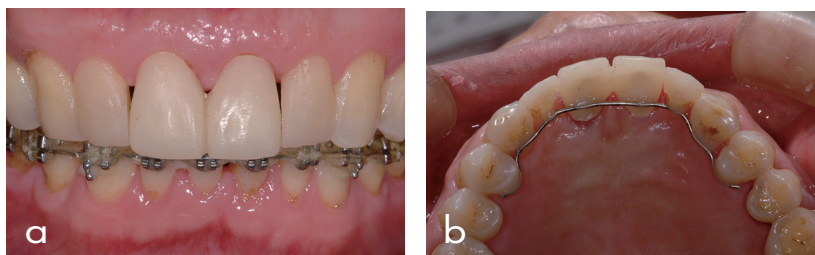


Fig 5. (a) Provisional crowns and veneers in place. (b) The palatal splinting wire in place.

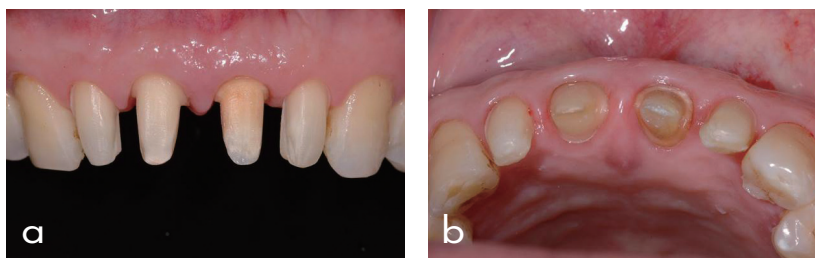


Fig 6. (a) Frontal view of tooth preparation for all-ceramic crowns and porcelain laminate veneers. (b) Occlusal view of tooth preparation and soft tissue architecture.

tion were reevaluated using recurring esthetic dental (RED) proportion analysis. The calculated RED proportion was approximately 70%. Maxillary and mandibular study cast were then taken with alginate impression for provisional restorations and palatal splinting wire. The provisional restorations were fabricated according to the diagnostic wax up. The provisional restorations were modified and adjusted until the phonetic, esthetic, and functional results were accepted by the patient (Fig. 5).

A circumferential 1 mm width of shoulder margin was prepared for full ceramic crowns of maxillary central incisors and a 0.3 mm width of chamfer margin was designed for laminate veneers of maxillary lateral incisors. Furthermore, a 1 mm subgingival margin on the mesial finishing line of centrals was prepared to eliminate the occurrence of black triangles (Fig. 6). To verify the adequate tooth length and appearance, a phonetic test (including F and S sounds) and an esthetic test (including tooth proportion, alignment, and color) were evaluated. After 3 months of wearing provisional restorations, the definitive impression was made using vinyl polysiloxane impression material (Aquasil, Dentsply/ Caulk, Milford, DE). The impression was poured with type III dental stone and a master cast was fabricated.

The master cast was mounted on a semi-adjustable articulator (Artex, Gierbach, Germany). Pressed ceramic crowns and veneers (IPS e.max, Ivoclar-Vivadent, Schaan, Liechtenstein) were fabricated for the maxillary central incisors and lateral incisors.

The definitive restorations were checked and adjusted in order to obtain optimal proximal contact, ideal gingival contour, and occlusal contact (Fig. 7). The definitive restorations were cemented with dual-cure resin cement (Variolink II, Ivoclar Vivadent, Schaan, Liechtenstein). Even contacts at maximum intercuspation and proper anterior guidance of the maxillary central and lateral incisors were made. A maintenance plan, which included oral hygiene instruction and prosthesis home care, was established. The patient and the interdisciplinary team were satisfied with the esthetic and functional outcomes of these definitive restorations.

Discussion

The arrangement and proportion of maxillary anterior teeth are the major determinants for a pleasing appearance. To evaluate and describe the ideal tooth-to-tooth proportion, Levin applied the golden proportion (proportion of 1.618:1.0) to relate the successive

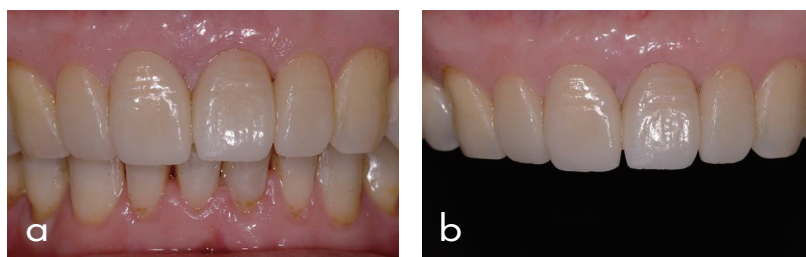


Fig 7. (a) Post-treatment intraoral view of definitive restorations. (b) Frontal view of the anterior maxillary restorations. Note the harmonious appearance between the restoration and the soft tissue.

widths of the anterior teeth as viewed from the front.¹⁰ The golden proportion implies that the maxillary central incisor should be 62% wider than the lateral incisor, which is consistent between the widths of the maxillary lateral incisor and canines. However, Preston reported that only 17% of the patients had the golden proportion in terms of the relationship between the maxillary central and lateral incisors.¹¹ In addition, when using the golden proportion, the lateral incisors and canines appeared too narrow. Therefore, Ward indicated that the recurring esthetic dental (RED) proportion was more appropriate to individually fit the face, gender, and body type of each patient.¹² The average range of RED proportion from 62% to 80% was considered acceptable. In this case, the RED proportion was calculated prior to removal of orthodontic brackets to confirm the ideal space distribution and the tooth-to-tooth proportion. The calculated RED proportion was 70%, which is also preferred by most of dentists in a study.¹³

In addition to presenting the importance of space management and tooth-to-tooth proportion, incisal edge position is one of major determinants for a pleasing smile. The adequate incisal edge position can be evaluated according to the phonetics and the display length both dynamically and at rest. Some studies demonstrated that the amount of maxillary anterior teeth at rest decreased in visibility with increasing age and longer upper lips.^{14,15} The exposure of maxillary central incisors at rest ranged from -0.04 to 1.37 mm in the patients over 50 years of age. Furthermore, smile displaying teeth including 2 to 4 mm gingiva were considered as the most esthetically pleasing.¹⁶

This clinical report presented an interdisciplinary approach to resolve esthetic defects, including diastema and peg-shaped lateral incisors. To design the definitive restorations, the RED proportion and incisal edge position were applied to evaluate the distribution of the spaces and the ideal tooth position before the completion of orthodontic treatment. All-ceramic crowns and porcelain laminate veneers

on the maxillary central incisors and lateral incisors were completed. The combination of orthodontic and prosthodontic treatments with careful diagnosis and planning were critical for improved esthetic and functional outcomes.

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