



Original Article

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Smile makeover in an esthetic-compromised patient: a multidisciplinary approach

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Abstract

This article is a case report of a patient who lost left permanent maxillary lateral incisor, canine and left permanent maxillary first premolar and alveolar bone due to the enucleation of eosinophilic granuloma. Also, the report described how a multidisciplinary approach may improve the esthetic outcome when only orthodontic treatment was insufficient. The early loss of permanent anterior teeth affected the harmony of the incisors shown and ultimately the esthetics of the smile, and was a challenge in treatment planning. The recurring esthetic dental (RED) proportion was used for space distribution. Esthetic crown lengthening was indicated to improve the gingival levels. Indirect porcelain veneers were used for tooth shape correction and space closure. The tooth alignment was maintained using orthodontic retainers. The follow-ups at 1 week, 1 month, 3 months and 6 months presented a very healthy gingiva. The patient was satisfied and felt more confident on her new pleasing smile.

(CU Dent J. 2012;35:201-12)

Key words: *correct tooth shape; multidisciplinary approach; space closure; veneers*

Introduction

Recently dental patients have become more focused on the esthetic aspect regarding to dental treatment, rather than the restoration of function. This trend has challenged dentists to approach dental esthetics in a more organized fashion. However, a patient's existing dental condition may not always be easily restored to the desired esthetic appearance without the assistance of other disciplines such as periodontics, orthodontics and prosthodontics. Therefore the dentist must understand the roles of various disciplines in order to produce an esthetic outcome.

The early loss of permanent anterior teeth in adolescent patients provides challenges to the prosthodontist and orthodontist in treatment planning. The absence of upper anterior teeth affects the harmony of the incisors shown and ultimately the esthetics of the smile. Treatment options to provide an esthetic outcome are either orthodontic space opening to allow prosthetic replacement or orthodontic space closure combined with resin composite or veneer restorations.¹ The proper diagnosis of dental and skeletal status provides for the selection of proper treatment alternatives. Treatment considerations depend on several factors: occlusion, existing space, tooth size, and root length.² While implant-supported prostheses may be considered as a possible treatment when establishing adequate spaces for missing teeth, their use is controversial when facial growth is not yet complete.^{3,4} Another treatment approach is orthodontic space closure, followed by restorative correction of any unusual anatomic configuration of the teeth. Orthodontic space closure might compromise resulting in functional and anatomic changes and esthetics. In order to achieve an esthetic final result, it is very important that the treatment plan be established only after a thorough review by these various disciplines.

This clinical report focuses on a multidisciplinary approach to the restorative management of one patient

who presented with missing maxillary left lateral incisor, canine and first premolar. The purpose of the treatment procedures was to correct the compromised anatomy, function and esthetics resulting from orthodontic space closure to achieve the optimal esthetic result.

Clinical report

A 3-year-old Thai girl presented at the Faculty of Dentistry, Chulalongkorn University, with an irregular mass on the upper left palate. Skin vesicles were found over the entire body. Intraoral examination also found chronic ulceration and gingival swelling of the buccal and lingual sides of the upper left alveolar ridge. The soft tissue was biopsied and the patient was diagnosed as eosinophilic granuloma without additional organ dysfunction. Eosinophilic granuloma is a chronic focal form of Langerhans cell histiocytosis (LCH), which is a slowly expanding proliferation of Langerhans cells in bones, with no extraskelatal involvement.^{5,6} The incidence of LCH is not precisely known, but is estimated to be 2-5 cases per million children per year.³ The cause of eosinophilic granuloma has not been identified. It is most often seen in children ages 1 to 15. The rate peaks among children ages 5-10 years. The treatment prognosis was good. Excisional biopsy or curettage was recommended.⁷ Surgical treatments consisted of enucleation of the eosinophilic granuloma, alveolectomy of the buccal cortex, and extraction of deciduous upper left central incisor, upper left lateral incisor and upper left canine, as well as extraction of the developing permanent upper left lateral incisor, upper left canine and upper left first premolar.

The absence of the maxillary anterior teeth resulted in alveolar ridge constriction, which affected the space of the maxillary anterior teeth. The upper right central incisor erupted across the midline into the upper left central incisor position (Fig. 1). Since the patient had a severe bony defect, bone augmentation of

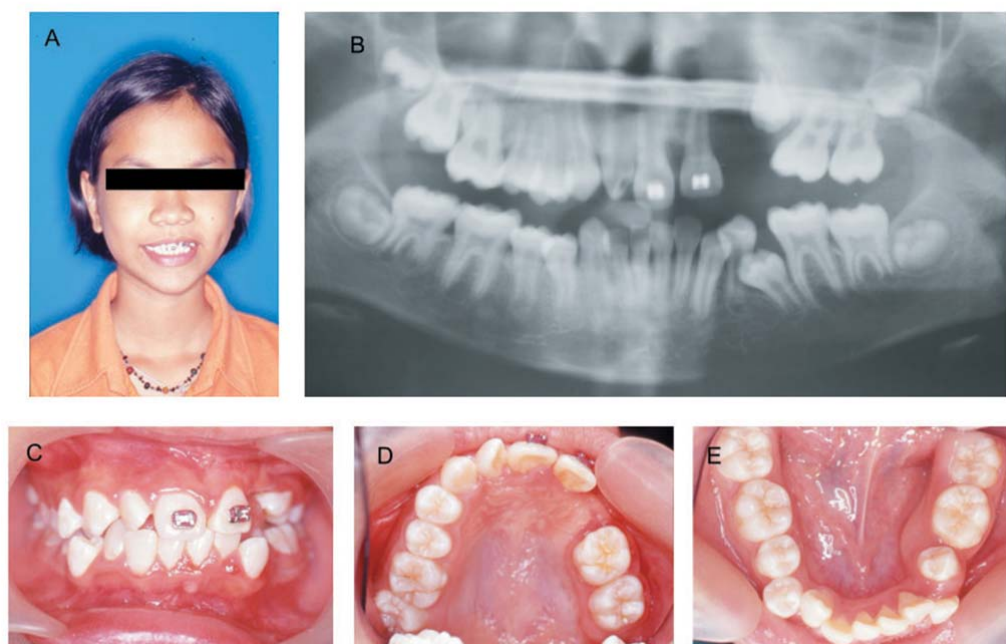


Fig. 1 These photographs showed patient's condition prior to receive orthodontic treatment at the age of 12.

- (A) Front view, full-face photograph of patient.
- (B) Panoramic view radiograph showed an unerupted upper left second premolar.
- (C) Frontal view in maximum intercuspation showed the maxillary central incisors migrated across the midline and anteriorly.
- (D) Occlusal view of upper arch presented crowding condition and missing upper left canine and first premolar.
- (E) Patient also had crowding in the lower arch as shown in the occlusal view of lower arch.

the maxillary left canine and first premolar was later performed using the iliac crest as a source of donor bones along with artificial eruption of the maxillary left premolar at the age of 12. A full-bonded orthodontic appliance was used for space closure by lateralization of the maxillary right central incisor, the maxillary right lateral incisor, the maxillary right canine and the maxillary left central incisor, to conform to the anterior left segment. The maxillary left central incisor was stripped out at the mesial part for 1 mm, and was lateralized to replace the maxillary left lateral incisor position.

At the age of 22, she was referred from the Department of Orthodontics to the Esthetics and Implant Clinic, Chulalongkorn University, for anterior

restorations, with a chief complaint of an esthetically unpleasant smile. The patient was in good general health, and the medical and dental history indicated no contraindication to dental treatment.

Facial analysis indicated a symmetric, mesofacial pattern with a straight profile. The interpupillary and commissural lines were parallel to the horizon. The facial midline was in the center of the face. Occlusal analysis showed anterior spacing, as shown in Fig. 2. The patient exhibited a class I molar relationship on the right side and a class II relationship on the left side. Group function was present without interference in both centric and eccentric occlusion. The occlusal plane was slightly angulated to the right. A panoramic radiograph was taken prior to receive restorative treatment (Fig. 3).

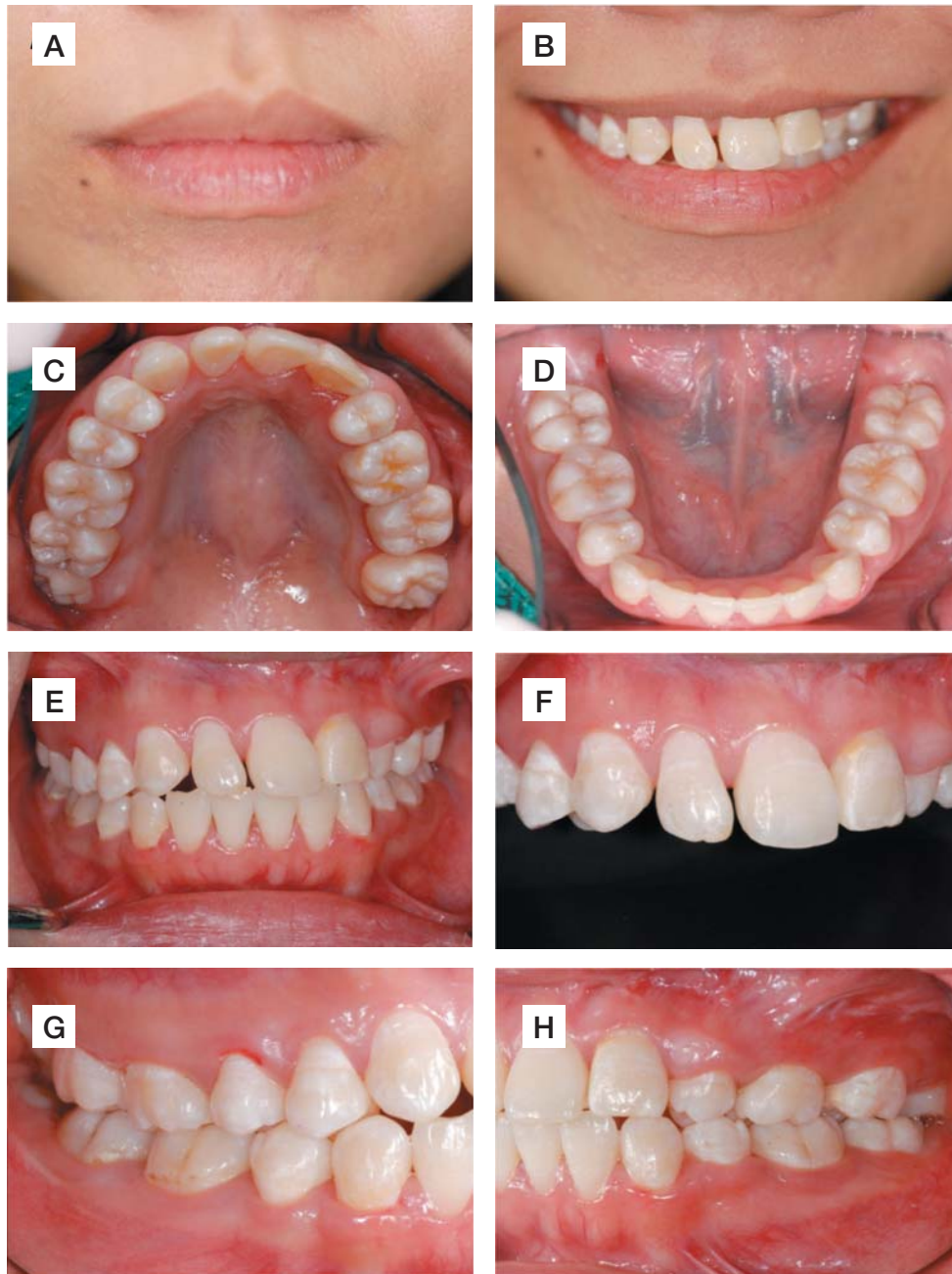


Fig. 2 Pre-operative photographs after orthodontic space closure. (A) Competent lips in resting position. (B) When smiling, the patient showed unusual shape of the transposed teeth and excessive gingival tissue on upper left second premolar. (C) Occlusal view of upper arch. (D) Occlusal view of lower arch. (E) Frontal view in maximum intercuspation. (F) Frontal view of upper anterior teeth. (G) Class I molar classification was found on the right side. (H) On the left sides, Class II molar classification was found.

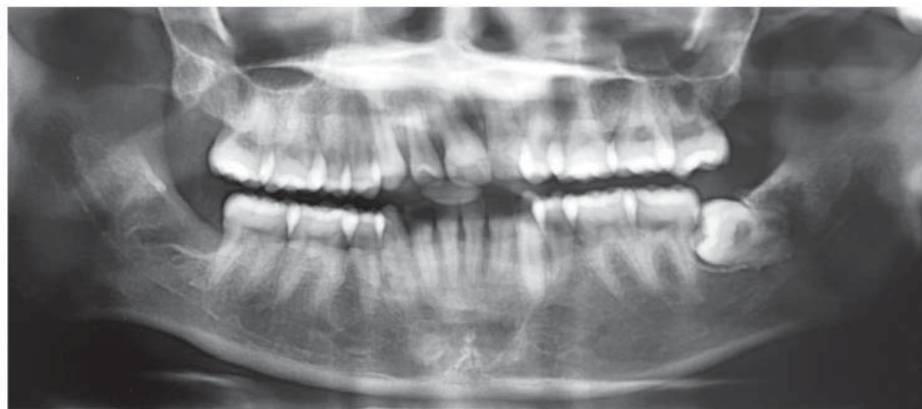


Fig. 3 A panoramic radiograph was taken prior to receiving restorative treatment.



Fig. 4 A diagnostic wax-up model was fabricated using RED proportion.

First, the relationship of the maxillary incisor and upper lip position was evaluated. There was approximately 4 mm of incisal edge display with competent lips at the resting position. Previous studies have shown that the amount of incisal edge display proportionally decreases with advancing age.^{8,9} The upper incisal curve was convex, and incisal edges were in contact with the vermilion border of the lower lip only on the right side. On the left side, the incisal edge of the lower anterior teeth slightly shown, due to the slanted occlusal plane. The buccal corridor was more obviously noticeable on the left side. A minimal buccal corridor (28% buccal corridor) is considered to be the most esthetic appearance by the nonprofessional.¹⁰ There was an average smile line, with 1.5 mm gingival display at the maxillary left second premolar when smiling.

Second, the maxillary dental midline was evaluated.

Studies have shown that as long as the dental midline is parallel to the midline of the face, midline deviations of up to 3 or 4 mm are not noticeable by the non-professional.^{11,12} The most important relationship to evaluate is the mesiodistal axis of the maxillary central incisors. Researchers have found that if the incisors are inclined by 2 mm to the right or left, the non-professional notices this discrepancy as unesthetic.^{5,13} In this case, the relationship between the upper interincisal line and the facial midline was deviated 1 mm to the right and slanted to the right. The upper and lower midlines deviated 1 mm to the right. Overbite and overjet were 2 mm and 2 mm accordingly. When the maxillary right central incisor erupted across the midline into the maxillary left central incisor space, the tooth axis was slanted to the right and the zenith was found toward the mesial side of the tooth, which compromised esthetics.

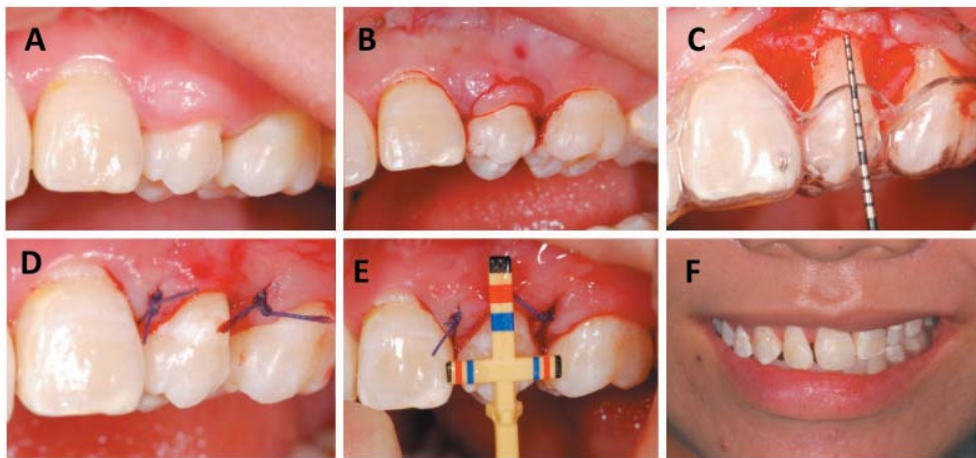


Fig. 5 Esthetic crown lengthening of the maxillary left premolar was performed.

- (A) Pre-operative photograph showed excessive gingival tissue.
- (B) Internal bevel and sulcular incisions were made prior to flap reflection.
- (C) The labial bone was reduced to 3 mm from the margin of surgical guide.
- (D) Post-operative photograph.
- (E) The proportion gauge was also utilized to determine the desired gingival level.
- (F) When smiling, no excessive tissue was shown after esthetic crown lengthening procedure.

The gingival level of the maxillary anterior teeth was evaluated. The ideal gingival levels should be relatively horizontal, and with symmetry on both sides. The patient had a thick gingival biotype with the presence of interdental papillae. There was an asymmetric gingival margin on the upper left second premolar, which appeared to be more coronal than the adjacent teeth.

A diagnostic wax-up model was made utilizing the recurring esthetic dental proportion.¹⁴ The patient's treatment began with esthetic crown lengthening of the maxillary second premolar for the correction of excessive gingival display. The gingival tissue was left to heal for 3 months prior to final restorations. The correct tooth width-to-length ratio,¹⁵⁻¹⁷ symmetry between both sides¹⁸ and the desired amount of gingival display¹⁹ were used to determine the gingival levels. From the diagnostic wax pattern, the new gingival level was determined to be symmetrical to the contralateral tooth (Fig. 4). A vacuum polyacetate matrix was fabricated and used as a guide for esthetic crown

lengthening. Also, esthetic crown lengthening was performed using an innovative instrument, a Proportion Gauge (Hu-Friedy, Chicago IL, USA) (Fig. 5).

Since the midline of the patient was slightly slanted, a new midline was determined using dental floss as a reference line from the tip of the nose to the tip of the chin. The maxillary right central incisor was prepared parallel to the facial midline to create the new midline. To mimic the gingival contour of the maxillary central incisor, a metal band was placed and contoured to the proper gingival architecture. Resin composite was used to fill the space as a provisional restoration.

A silicone index was made from the diagnostic wax pattern and used as a guide for minimal tooth preparation. This silicone index was utilized to evaluate the space after preparation for sufficient thickness of the porcelain veneers. The maxillary right canine was flattened to mimic the anatomy of the lateral incisor. The depth-cutting bur is used to ensure uniform and adequate tooth reduction facilitating the fabrication of aesthetically pleasing veneer restorations. The chosen

minimum thickness of the final restoration is 0.5 mm uniformly. The bur was placed vertically in three zones of depth cuts, gingival, middle and incisal of 0.5 mm, followed by finishing and polishing of the preparations. The preparation margin was placed 0.5 mm subgingivally (Fig. 6). The gingiva was retracted with Ultrapak retraction cord #000 (Ultradent Products, South Jordan UT, USA) prior to the final impression; the impression was taken using polyvinyl siloxane (Flexitime[®], Heraeus Kulzer, Hanau, Germany). The occlusion was recorded by thixotropic vinyl polysiloxane (Blu-Mousse[®], Parkell, Edgewood NY, USA). A lingual silicone index was fabricated from the model to simplify the temporalization procedure. Flowable resin composite (Premise[™] Flowable; Kerr, Orange CA, USA) was applied along the proximal and incisal edges. Provisional restorations were made using resin composite, A1 shade (Premise, Kerr) without etching, priming or bonding steps. The restorations were polished using polishing burs, and the gingival margins were finished with a

scalpel blade no.12. Tooth photographs were sent to the laboratory (Dental Art Lab, Bangkok, Thailand) for the purpose of communication between the dentist and dental technician regarding texture, color, translucency and anatomy of the teeth. The contact and contour of the wax patterns were examined, prior to heat pressing. Then the wax patterns were tried-in to ensure that the midline and slanted incisal plane had been corrected. Mamelons were created to give a natural look for the adolescent patient. The heat-pressed ceramic IPS Empress[®] Esthetic (Ivoclar Vivadent, Schaan, Liechtenstein) shade A1 was chosen. At the try-in and cementation visit, the proximal contacts and marginal adaptation were checked until the veneers were comfortably seated. The veneer color was also checked using water as a medium to predict the outcome in a more reliable way. To place the veneers, the tooth preparations were cleaned using pumice and rubber cup, and etched with 37% phosphoric acid (Gel Etchant, Kerr). An alcohol-based adhesive (OptiBond FL, Kerr) was



Fig. 6 (A) A guide depth was prepared prior to veneer preparation (B) The preparation was created followed by polishing and finishing. (C) The porcelain veneers were tried-in and cemented using clear resin cement (NX3 Nexus, Kerr, USA).

applied onto the tooth surfaces. The porcelain veneers were cemented using clear resin cement (NX3 Nexus, Kerr). Excess cement was carefully removed using a scalpel blade no.12 to avoid damaging the porcelain veneer margin. Oral hygiene instructions for brushing and flossing were given. After veneer cementation and recheck, an orthodontic retainer was delivered to maintain the alignment of the teeth (Fig. 7). The follow-ups at 1 week, 1 month, 3 months and 6 months presented a very healthy gingival condition and the patient felt more confident with her new smile (Fig. 8).

Discussion

The most common problems of orthodontic space closure are unusual function, shape, dimension and color of orthodontically transposed units.²⁰ To overcome these deficiencies, a comprehensive treatment approach had to be considered. The goal of treatment was to correct

the anatomy of the transposed teeth. It must be thoroughly focused prior to restore the anterior teeth, and can be achieved by using a diagnostic wax-up model. The diagnostic wax-up model mimics natural dentition and desired gingival architecture, and is used to illustrate the final esthetic outcome. Also, it can be used as a means of communication between other specialists and technicians, allowing reversible modification.^{21,22} It can also be used as a patient education tool.²³

The distribution of spaces between the anterior teeth may be decided by the restorative dentist in order to achieve the most favorable esthetic results. In this study, the recurring esthetic dental (RED) proportion was used for analyzing space distribution. From the study by Ward *et al.*,¹⁴ the RED proportion states the proportion of the successive widths of the maxillary teeth as viewed from the front should remain constant, progressing distally. The width of the lateral incisor is decreased by a selected percentage from the width of

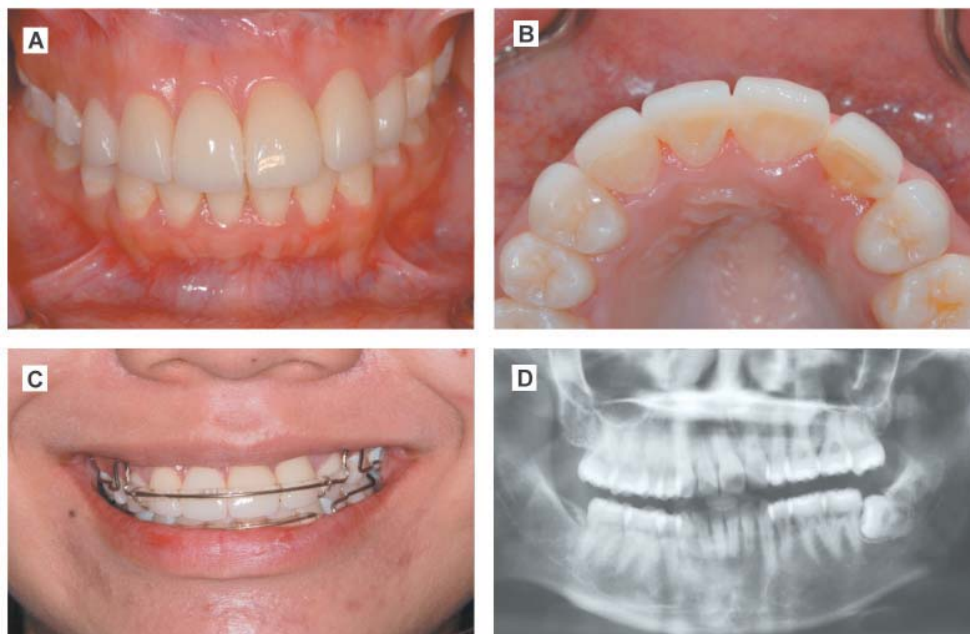


Fig. 7 (A) The patient exhibited healthy marginal gingiva and completely filled interproximal papillae. (B) Occlusal view of upper anterior teeth. (C) Tooth alignment was maintained with retainers. (D) A panoramic radiograph was taken at 3 month follow-up.



Fig. 8 (A, B) Pretreatment smile **(C, D)** Photographs showed an improvement in the appearance of the patient’s smile. The patient was satisfied and felt more confident with her new smile.

the central incisor, and the width of each tooth distally is decreased by this same percentage from its mesial tooth. The 70% RED proportion has been recommended for normal length teeth, with a 78% width/height ratio of the maxillary central incisors. When using the 70% RED proportion, the width of the maxillary lateral incisor is 70% of the frontal view width of the maxillary central incisor, and the maxillary canine is 70% of the width of the resulting lateral incisor. For very short teeth, a RED proportion approaching 80% is recommended. Gradations within the range of 62 to 80% RED proportions may be used based on the amount of deviation from normal lengths.

However, after orthodontic therapy, our patient presented with multiple spacing, excessive gingival tissue, and slightly slanted occlusal plane, midline and

smile line. Furthermore, the axis of the right maxillary central incisor was slanted to the right. In this case, the goal of treatment was to correct the unusual shape, function, dimension and color of orthodontically transposed units. A multidisciplinary approach was indicated in order to achieve a successful esthetic result in this patient. The final occlusal scheme was designed to be a group function after space closure by the orthodontist.^{2,25} The dental midline should be the first to be corrected to appear parallel to the facial midline. In this case, the width/height ratio of the central incisor was 75%, which is considered to be a slightly short tooth according to the RED proportion. The remaining teeth exhibited RED proportions ranging from 71.43%–77.78%, which is acceptable, particularly in the case of shorter teeth.

Since the left maxillary second premolar had excessive gingival tissue, esthetic crown lengthening was indicated. The diagnostic wax-up model was also used to form the surgical template to determine the final gingival margin in this procedure. Not only the surgical template was used; a proportion gauge was also utilized to confirm the tooth proportion in this procedure. The soft and hard tissue maturation should then be left undisturbed for 7 weeks up to 6 months.²⁶ From the study by Wise *et al.*,²⁷ the final restoration should not be made before 20 weeks after esthetic crown lengthening. The restorations can be fabricated when the tissues have stabilized for 4 weeks during provisional restorations. In this case, the tissue was left to heal for 3 months to ensure the stability of the tissue. During the healing time after the crown lengthening procedures, the mesial papilla of the right maxillary lateral incisor was contoured using resin composite to mimic the gingival architecture of the central incisor, and was left in place for 1 week.

The distal part of the right maxillary incisor was prepared to be straight and parallel to the facial midline, as determined by the reference point from the tip of the nose to the tip of the chin. The right maxillary canine cusp was flattened and the labial convexity was reshaped to re-create a normal lateral incisor.^{2,20} Canine labial reduction should be carefully prepared, as it can result in a yellower or greyer tooth.²⁸

The wax patterns were tried-in to ensure that the midline and slanted incisal plane had been corrected prior to heat-pressing. The most coronal point of the gingival margin, so-called zenith point, can enhance the perception of the tooth axis. Since the zenith of the right maxillary central incisor was found to be more toward the mesial side of the tooth, this could compromise the esthetics. The wax pattern was fabricated, especially on the cervical third of the distal line angle, to create the illusion of the tooth being narrower and distally tilted.

Empress esthetic was chosen as the material of

choice due to the material provided excellent marginal fit and its translucency properties. The porcelain veneers were tried in using water as a medium to predict the final outcome prior to cementing with clear resin cement.

The patient was instructed to practice how to smile more naturally and symmetrically. Incisal edges of the maxillary anterior teeth should coincide with the vermilion border of the lower lip for a pleasing smile. A symmetrical smile is achieved when the commissural line is controlled to be parallel to the interpupillary line and the occlusal plane.²⁸ The patient felt more confident with her new pleasing smile (Fig. 8).

Conclusion

This clinical report describes how a multidisciplinary approach combining restorative, periodontal and orthodontic dentistry may improve the esthetic outcome when orthodontic treatment alone is not sufficient. Indirect porcelain veneers were applied to correct tooth shape, spacing, and to improve the patient's smile after orthodontic treatment and periodontal surgery. The recurring esthetic dental (RED) proportion was used for analyzing space distribution. In order to improve the gingival levels, esthetic crown lengthening was indicated. Indirect porcelain veneers were used for tooth shape correction and space closure.

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บทคัดย่อ

รายงานการรักษาผู้ป่วยที่สูญเสียฟันหน้าแท้จากฟันตัดข้างแท้ด้านบนซ้ายถึงฟันกรามน้อยแท้ซี่ที่ 1 ด้านบนซ้าย และกระดูกเบ้าฟันบางส่วนจากการผ่าตัดเพื่อกำจัดอิวอสินฟีลติก แกรนูโลมา และอธิบายการบูรณะฟันแบบสหสาขาวิชาชีพที่ปรับปรุงให้เกิดความสวยงามในกรณีนี้ที่แก้ไขโดยการจัดฟันอย่างเดียวไม่เพียงพอ การสูญเสียฟันหน้าหลายซี่ทำให้มีผลต่อความกลมกลืนของปลายฟันหน้าและรอยยิ้มสร้างความท้าทายให้กับทันตแพทย์ในการวางแผนการบูรณะ คำตัดสินคงที่ถูกใช้คำนวณเพื่อวิเคราะห์สัดส่วนฟันหน้า ผ่าตัดเพิ่มความยาวฟันเพื่อปรับปรุงระดับเหงือก บูรณะฟันด้วยเคลือบฟันเทียมเพื่อแก้ไขรูปร่างฟันและปิดช่องว่างฟันที่เหลืออยู่หลังการจัดฟัน หลังการบูรณะด้วยเคลือบฟันเทียม การเรียงตัวของฟันถูกคงสภาพด้วยเครื่องมือคงสภาพฟัน จากการติดตามการรักษาเป็นเวลา 1 สัปดาห์ 1 เดือน และ 6 เดือน พบว่าผู้ป่วยมีเหงือกแข็งแรง พอใจ และมีความมั่นใจกับรอยยิ้มใหม่เพิ่มขึ้น

(ว.ทันต. จุฬฯ 2555;35:201-12)

คำสำคัญ: แก้ไขรูปร่างฟัน; เคลือบฟันเทียม; ปิดช่องว่างฟัน; ทีมสหสาขาวิชาชีพ