Anterior Space Management: Interdisciplinary Concepts

IYARINT ITTIPURIPHAT, DDS, PhD*, **CHALERMPOL LEEVAILOJ,** DDS, MSD, ABOD, FRCDT†

ABSTRACT

This case report describes the treatment of one patient with maxillary anterior spacing, caused by bilateral lateral peg-shaped incisors, using a planned sequence of multidisciplinary approaches for esthetic treatment. An asymmetrical gingival line was visible when the patient smiled. To evaluate the desired gingival level and the proportion of restoration to be made using the recurring esthetic dental (RED) proportion method, a diagnostic wax-up model was fabricated. Esthetic crown lengthening corrected the gingival line. RED proportion analysis suggested minor tooth movement prior to any restoration. Two weeks' use of an orthodontic removable appliance with finger springs achieved the proper dental proportion. Home whitening was prescribed for 2 weeks, with an additional 2-week waiting period to ensure tooth color stability. Resin composite treatment corrected the mesial contour of the maxillary canines and reduced the space between the canines and lateral incisors. Final restoration was obtained by placing ceramic veneers on the lateral peg-shaped incisors. The esthetic treatment achieved excellent results; after veneer cementation, the patient exhibited greater confidence with a new smile.

CLINICAL SIGNIFICANCE

Esthetic dental treatment requires various disciplines to achieve the treatment goal. This case report is an example of well-planned sequences of treatment from the beginning to complete treatment. By conservative and practical treatment approaches used in this case, the clinician will be able to manage to obtain the highest result of esthetic treatment.

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INTRODUCTION

Improper anterior spacing can be caused by microdontia, a condition in which the teeth are abnormally small. Microdontia can be found in many forms, most commonly involving the maxillary lateral incisors—so-called "peg lateral" incisors. These are defined as undersized, tapered maxillary lateral incisors.[1] This condition occurs as a result of underdeveloped permanent teeth. Peg-shaped lateral incisors tend to be hereditary and often cause multiple spaces in the dental arch that result in the alteration of the occlusal pattern. Bäckman and Wahlin (2001) found that peg-shaped maxillary lateral incisors occurred more frequently than other developmental malformations of the teeth, with an incidence of 0.8% in 739 Swedish children.[2] Several other studies have reported an association between the presence of peg-shaped maxillary lateral incisors and agenesis of maxillary lateral incisors. Interestingly, the occurrence of peg-shaped incisors and lateral incisor agenesis was predominantly found on the left side of the maxilla.[3,4] One study of 8,289 students found that 1.78% exhibited either peg-shaping or agenesis of permanent maxillary lateral incisors, with a greater frequency in females.[4]

*Graduate Student, Esthetic Restorative and Implant Dentistry, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

†Associate Professor, Program Director of Esthetic Restorative and Implant Dentistry, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

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Treatment choices for lateral peg-shaped incisors are dependent on the patient's expectations and the expertise of the clinician. The most drastic is extraction of the peg teeth. This may be the best option when there is insufficient root support or a malformed root, with subsequent tooth replacement with an implant, preparation of adjacent teeth for a fixed partial denture, and/or orthodontic arrangement of the canines in the open space. When there is sufficient root support, many more treatment options for peg-shaped lateral incisors are available; these range from direct composite veneers and indirect ceramic veneers to a full-contour crown.

A patient with peg-shaped lateral incisors will often possess multiple spaces in the anterior maxillary region. Tooth position may complicate the achievement of well-proportioned anterior restorations. To determine the proportions of the final restoration, a wax model of the existing dental proportions should be evaluated. If only minor tooth movement is needed, the use of a removable orthodontic appliance in combination with finger springs has proven successful. If tooth position cannot be corrected by these methods, then orthodontic treatment for space management is indicated.

The most conservative approach to correcting tooth shape is direct resin composite bonding because it can be achieved without removal of tooth structure.[5,6] Resin composite veneers are easily reshaped and polished, especially in the emergence angle of the crown. Treatment is usually completed in one appointment. In addition, direct resin composite bonding treatment is less expensive compared with ceramic veneers.

Indirect porcelain veneers are another conservative option for esthetic dental treatment.[5] Although porcelain veneers are more costly than resin composite bonding, they provide superior esthetics and a more natural appearance. Also, porcelain possesses high-abrasion resistance and good color stability. Therefore, the esthetics and longevity of these restorations surpass those of composite esthetic bonding.[6]

This clinical case report describes the sequence of a multidisciplinary treatment of a female patient performed at Chulalongkorn University's Esthetic Restorative and Implant Dentistry clinic. The patient was chosen because her peg lateral incisors had caused spaces in the anterior maxillary region, and she had excessive gingival display in her smile. Treatment included esthetic crown lengthening, space redistribution utilizing a removable orthodontic appliance, home whitening, and a combination of porcelain veneers and direct resin composite restorations.

CLINICAL REPORT

Figures 1 and 2 show a 21-year-old female who presented with microdontia of both maxillary lateral incisors (#7, #10) and with multiple spaces. The patient had undergone orthodontic treatment within the past 3 years and wore orthodontic retainers occasionally. A brief evaluation of her medical history indicated no immediate concerns. Despite her recent orthodontic treatment, the space between the left lateral incisor (#10) and central incisor (#9) was greater than the space between the right lateral incisor (#7) and central incisor (#8). Moreover, there was evidence of diastema between both central incisors (#8, #9). Radiographic examination showed normal anterior maxillary teeth

FIGURE 1. Frontal view showing space between maxillary central incisors. The upper dental midline is deviated 1 mm to the right.

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FIGURE 2. Occlusal view showing spaces between maxillary central incisors, and between lateral incisors and canines.

and periapical condition (Figure 3). A smile analysis was performed. Excessive gingival display was observed at the left central and lateral incisors when the patient fully smiled.

The dental midline was deviated 1 mm to the right compared with the facial midline, despite the patient having undergone previous orthodontic treatment. The evaluation continued with the inclination and arrangement of maxillary teeth. The patient possessed a high lip line.[7] Incisal curvature showed convex curvature of incisal edges that harmonized with the lower lip line when smiling. The right side of the lower lip dropped lower than the left, allowing the lower teeth and buccal corridor to be visible (Figure 4). The patient had an asymmetrical gingival level between the right and left sides of the upper dental arch. The excessive gingival level on the left side caused the left maxillary incisors (#9, #10) to appear shorter than the right. Examination of the maxillary dental shade and contour showed the central incisors as having a light yellowish color while displaying a grayish translucency line at the incisal edges. The peg-shaped lateral incisors and canines were darker. Mild fluorosis could be seen at the edges of the upper anterior teeth. The left central incisor (#9) was chipped at the incisal edge. Lateral incisors and canines were small and unequally distributed (Figure 5).

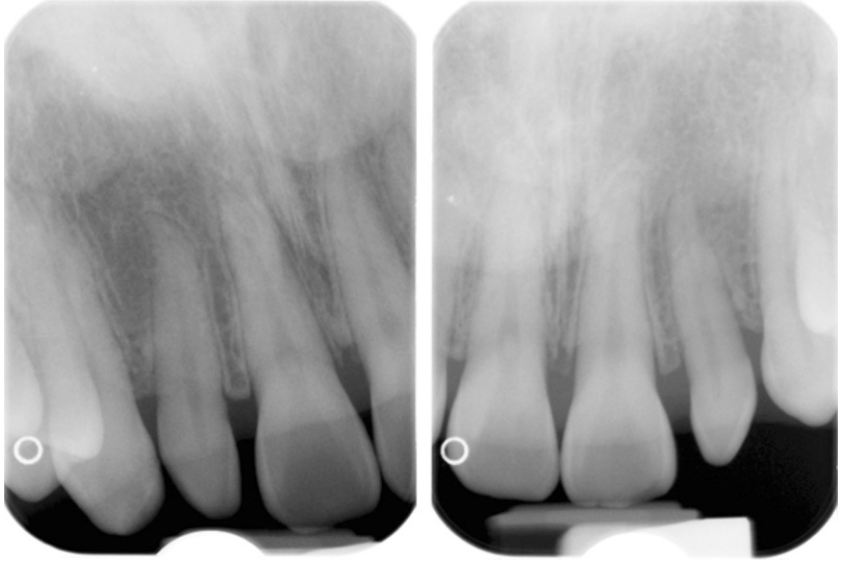

FIGURE 3. Radiographs showing sound maxillary teeth and normal periapical tissue.

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FIGURE 4. The relationship between maxillary incisors and lips. Buccal corridors and right lower anterior teeth can be seen when the patient smiles.

Tooth spacing and dental proportion were analyzed based on the recurring esthetic dental (RED) proportion,[8] the repeat ratio which can be calculated using the following formula:

$$\frac{\text{maxillary lateral incisor width}}{\text{central incisor width}} = \frac{\text{canine width}}{\text{lateral incisor width}}$$

In an esthetic smile, the proportion or ratio between the central and lateral incisor should be constant, progressing anteriorly to posteriorly in the mouth.[9]

TREATMENT PLAN

The following treatment plan was agreed to with the patient:

1 Periodontal surgery—to correct the gingival level of the left central incisor, lateral incisor, and canine (#9, #10, and #11) with a 3-month healing period.
2 A removable orthodontic appliance with finger springs—to close the space between the left and right central incisors (#8, #9) and to move the left lateral incisor (#10) 1 mm mesially, thus reducing the space between the left central incisor (#9) and the left lateral incisor (#10).
3 A clear retainer—to maintain the tooth position after minor tooth movement.
4 Home whitening with 10% carbamide peroxide for 2 weeks—to provide the patient with the whiter teeth she desired.

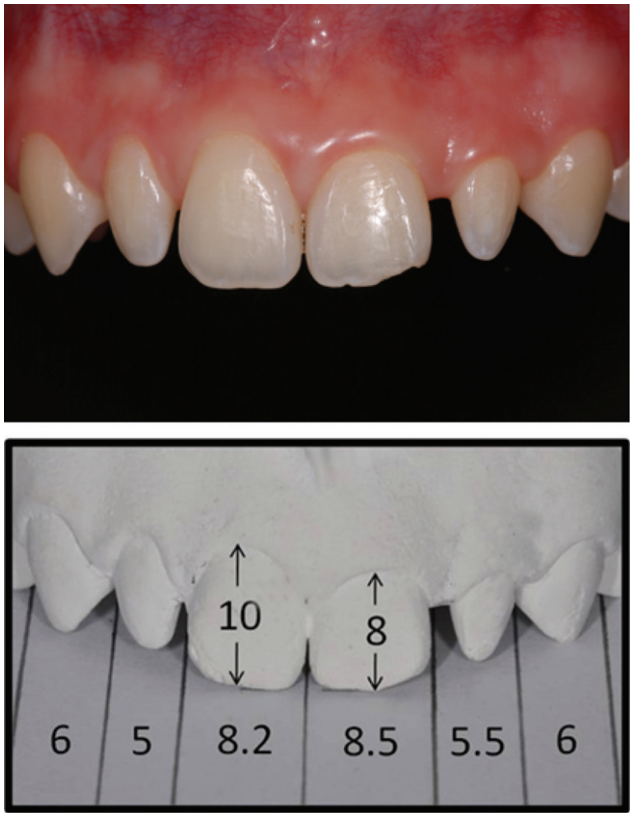

FIGURE 5. Six anterior maxillary teeth and the characteristics of central incisor (top). Analysis of the dental study cast shows the width of each tooth (bottom). The left lateral incisor (5.5 mm) is wider than the right lateral incisor (5 mm), and the spaces are unequally distributed.

5 Direct resin composite restorations—to restore the mesial surfaces of the left and right canines according to the RED proportion and to correct the chipped incisal edge of the left central incisor.
6 Finally, porcelain veneers—to restore the peg-shaped lateral incisors. Acrylic retainers were to be provided to maintain tooth alignment after treatment.

TREATMENT PHASE

Periodontal Surgery

Esthetic crown lengthening was performed on the gingiva of the left incisors and left canine in order to improve the gingival margin level (Figure 6). A wax-up model of the six anterior teeth was created to

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FIGURE 6. Esthetic crown lengthening was performed on teeth #9, #10, and #11.

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determine the proper relation of gingival level. Then ethylene vinyl acetate (EVA) vacuum trays were fabricated from a stone model created from the wax-up. The vacuum trays were used as surgical stents during the esthetic crown lengthening procedure. Soft tissue and crestal bone contouring were performed, and a 3-mm space relationship between the crest of bone and new gingival margin was maintained. The soft tissue was repositioned and then sutured with 5-0 Vicryl (Ethicon/Johnson & Johnson, Somerville, NJ, USA). The sutures were removed 10 days after surgery, followed by a healing period of 2 months under observation.

Removable Orthodontic Appliance

Minor tooth movement was needed to redistribute the spaces (Figure 7). A Hawley retainer was modified into an active appliance with adjustable springs[10] and was used to move tooth #10 mesially 1 mm and to move tooth #11 mesially to close the median diastema. The components of the appliance included: an anterior labial arch wire from distal of tooth #6 to distal of tooth #11; finger springs at distal of tooth #8 and tooth #10; Adams clasps at both left and right first upper molars; and ball-end clasps between the upper premolars and the acrylic portion, completing the assembly. The patient was instructed to wear the appliance 24 hours a day, but to remove it when eating and brushing. The springs were adjusted once a week. After 2 weeks, the teeth had moved to the desired location. A diagnostic wax-up of post-treatment showed harmonious dental proportions, with a repeat ratio of approximately 0.73 to 0.76 (Figure 8). EVA clear retainers were fabricated in order to stabilize the teeth.

Home Whitening

The teeth were whitened using an EVA clear retainer and 10% carbamide peroxide (Opalescence®; Ultradent Products, South Jordan, UT, USA) on the upper anterior teeth for 2 weeks. Bleaching trays were fabricated with a 0.035-inch-thick, 5 × 5-inch soft tray material (Sof-Tray, Ultradent Products) for the lower teeth. Trays were trimmed at 2 mm below the gingival line. The patient was instructed to wear the bleaching trays with 10% carbamide peroxide gel approximately 6 hours a day for 2 weeks. Vita Classic shade B1 (Vitapan® classical; Vita Zahnfabric, Bad Säckingen, Germany) was achieved after 2 weeks of treatment (Figure 9).

Direct Resin Composite

With teeth whitening complete, a 2-week waiting period was observed before commencing the next phase. Resin composite was placed at the mesial aspect of both upper canines using a silicone index (Flexitime®; Heraeus Kulzer, South Bend, IN, USA) duplicated from the diagnostic wax-up model. The silicone index was placed at the lingual surface of restored teeth to help determine the proper size of the final restorations. The enamel surface of right canine was etched with 37.5% phosphoric acid (Kerr Gel Etchant; Kerr, Orange, CA, USA) to remove any residual debris, until a chalky-white surface was obtained. An alcohol-based adhesive system (OptiBond™ FL; Kerr) was applied and light-cured. A thin layer of universal nanofilled restorative material (A1 shade, Premise; Kerr) was then added. To mimic the halo effect of the incisal edge, color modifier (Kolor + Plus®; Kerr) was used for internal staining. Finally, the resin composite was contoured, finished, and polished (Figure 10).

Porcelain Veneers for Lateral Incisors (#7, #9)

To minimize invasiveness of this procedure, a silicone jig derived from the diagnostic wax-up was used to aid in the preparation. A definitive margin of 0.5 mm beneath the gingiva was maintained (Figure 11). Impressions of prepared teeth were made and sent to the lab. Reference photographs of the teeth were taken, and porcelain veneers were fabricated and characterized accordingly. Porcelain veneers were made from pressed ceramic (IPS Empress® Esthetic, E TC-1 ceramic ingot; Ivoclar/Vivadent, Schaan, Liechtenstein) with a layering of veneering ceramic to mimic the halo enamel. The gross characteristics, such as the mamelon and vertical/horizontal grooves, were created. The fabricated veneers were examined and checked for fit in the stone dies and model. The veneers were tried in using water-soluble try-in paste (Nexus 3, white opaque and bleach shades; Kerr) (Figure 12). The lateral incisors were cleaned with wet pumice applied with a

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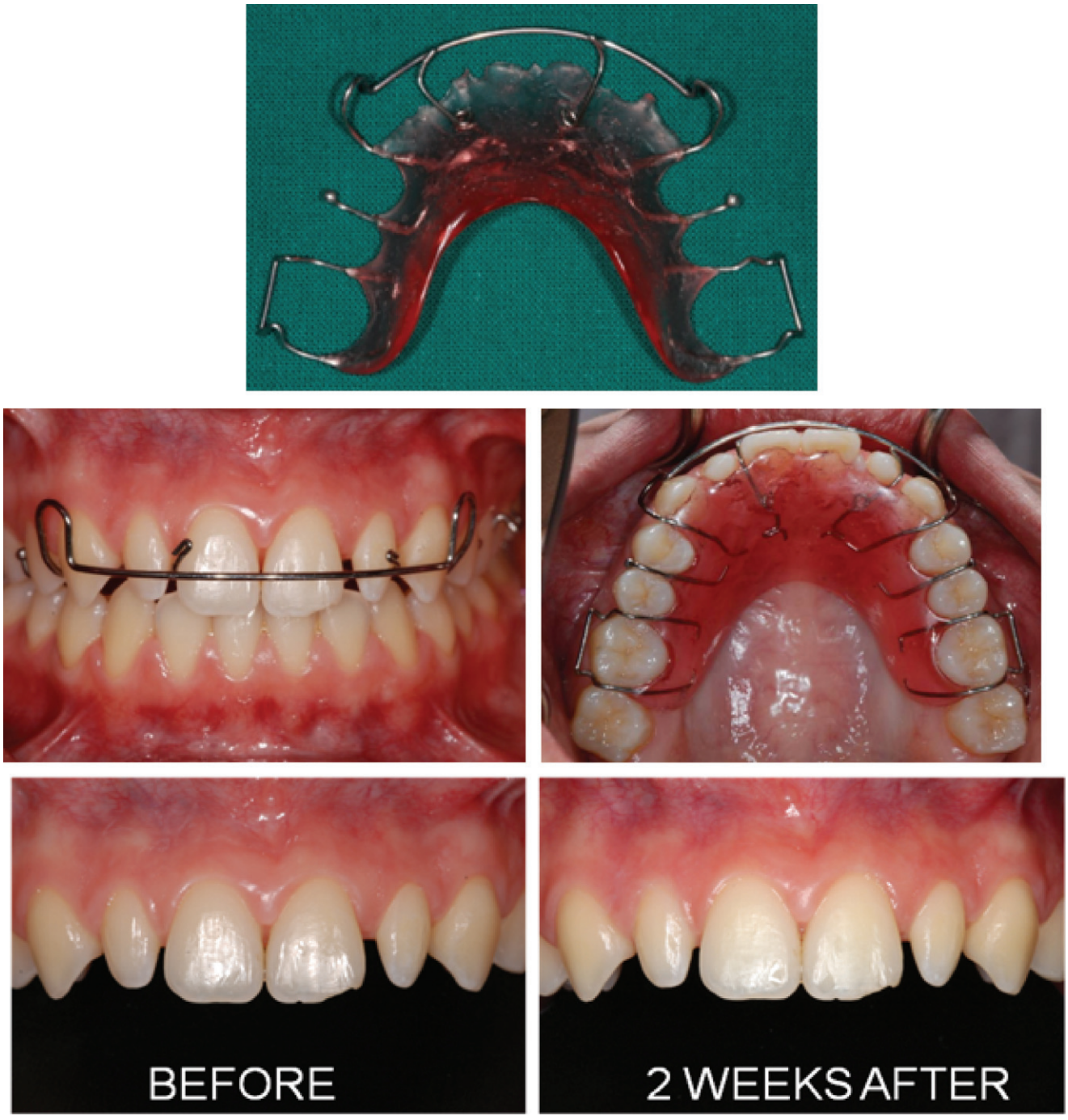

FIGURE 7. A removable orthodontic appliance with a finger spring on the distal surfaces of teeth #8 and #10 was given to the patient. After 2 weeks of minor tooth movement, the small median diastema was closed, and tooth #10 moved mesially 1 mm.

rubber cup and then etched with 37.5% phosphoric acid (Kerr Gel Etchant; Kerr). This was followed by application of an alcohol-based adhesive system (OptiBond FL; Kerr). The veneers were cemented with light-curing cement (white opaque shade, Nexus 3; Kerr) (Figure 13). Radiographs were taken to ensure non-overhanging restorations (Figure 14).

The results showed excellent incisal translucency, youthful characterization, and natural color. The

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patient was then instructed on how to take care of her restorations, and she was provided with the retainers (Figure 15). Follow-up evaluations at 1 month and 6 months after cementation exhibited exceptional results (Figure 16). Most importantly, the patient was very satisfied with her new, confident smile (Figure 17).

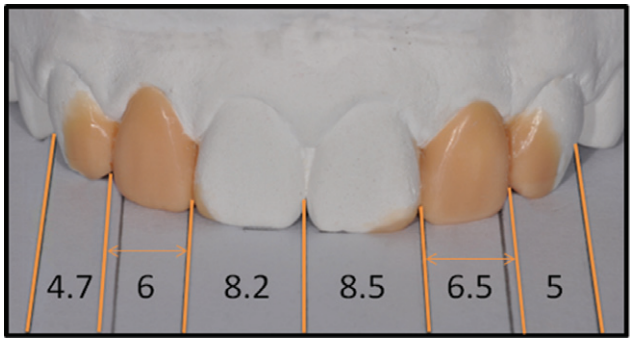

FIGURE 8. Diagnostic wax-up model after minor tooth movement shows the width of each tooth. Planned restorations on lateral incisors will result in more harmonious dental proportions.

DISCUSSION

A treatment plan is necessary as an aid in communicating to the patient what is required by a multidisciplinary treatment, as well in coordinating the overall treatment with others involved. A diagnostic wax-up is an initial visualization tool useful in representing the desired final outcome of the treatment. The wax-up model can be used as a guide to communicate with the patient and other doctors who are involved in the treatment. Orthodontic treatment often plays an important role in multidisciplinary esthetic treatments to correct the tooth position and the interarch relationship, manage the dental proportion, and improve the smile line. In this case

FIGURE 9. Home whitening was prescribed for 2 weeks. The result of treatment shows a final shade comparable with Vita Classic shade B1 (Vitapan® classical, Vita Zahnfabric, Bad Säckingen, Germany).

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FIGURE 10. Direct resin composite restorations were made on the mesial aspect of tooth #6 and tooth #11, and the chipped incisal edge of tooth #9. A silicone matrix was used to determine the proper size of final restorations.

FIGURE 11. Minimal tooth preparation for ceramic veneers was performed on teeth #7 and #9. Direct resin composite restorations served as provisional restorations.

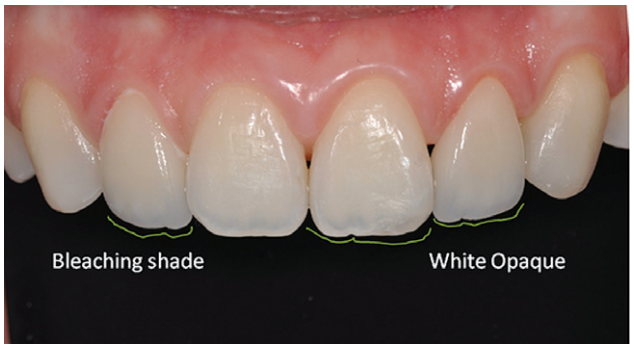

FIGURE 12. Gross characteristics of the veneers can mimic the natural appearance of a patient's teeth. Try-in cementation was performed utilizing two shades. Shade "White Opaque" was selected for the final cementation.

report, the patient had received prior orthodontic treatment before arriving at our dental clinic. Orthodontic treatment alone usually takes longer than other treatments. Our multidisciplinary approach achieved all of the final esthetic dental improvement goals in a shorter period of time.

To depict the overall treatment outcome, the first diagnostic wax-up with the desired gingival margin was

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FIGURE 13. Cementation of veneers on lateral peg-shaped incisors.

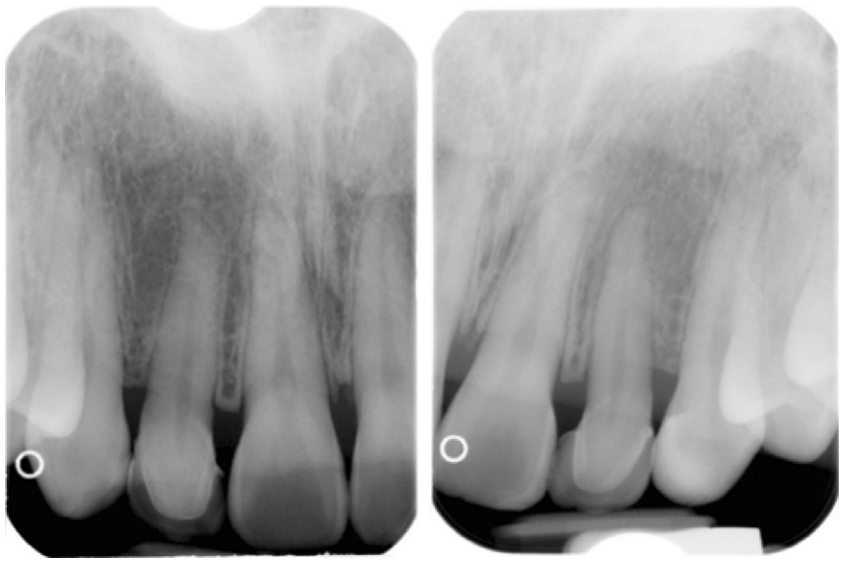

FIGURE 14. Radiographs were taken to ensure non-overhanging restorations.

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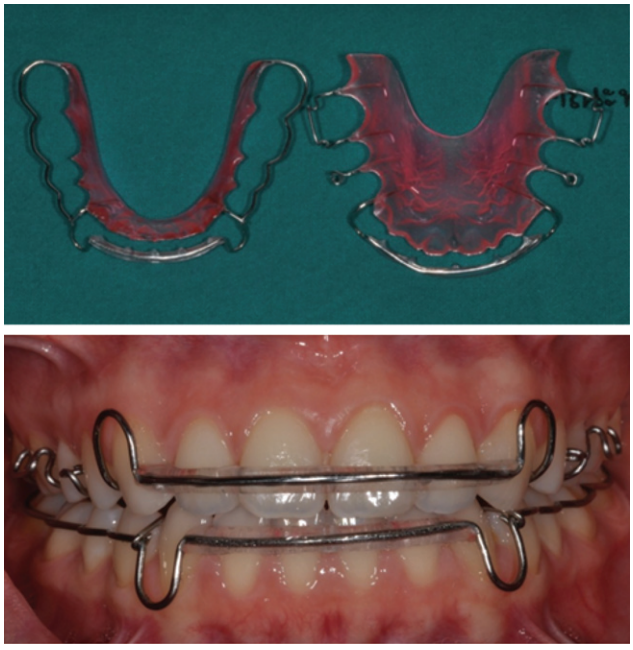

FIGURE 15. Hawley retainers were given to the patient.

made after the patient agreed to start the treatment. The diagnostic wax-up was used to explain how a proportional balance of dental and gingival tissues influences the beauty in facial soft tissue—especially the perception of tooth size that can result in an unpleasing smile when excessive gingival tissue is displayed.[11] An esthetic crown lengthening procedure was performed to adjust gingival levels for esthetic purposes. The increased enamel surface after surgery provided another benefit: more surface area for porcelain bonding of the final restorations.

Maintenance of a biological width of approximately 2 mm is important. Violating the biological zone will result in gingival inflammation, pocket formation, and eventually alveolar bone loss. Maintaining a 3-mm distance from the marginal gingiva to the alveolar bone crest is highly recommended to ensure an adequate biologic width when placing the restoration 0.5 mm under the gingival margin.[12] After esthetic crown lengthening, soft tissue can mature within about 7 weeks whereas the hard tissue can take up to 6 months. For patients with major esthetic concerns, it is suggested to wait as long as possible before final restoration in order to ensure stable tissue position and

FIGURE 16. Comparison photos of pretreatment (top), follow-up after 1 month (middle), and after 6 months of treatment (bottom).

gingival sulcus.[12,13] Wise (1985) advised that the definitive restoration should not be made within 20 weeks and suggested that the restoration be made after the position of the gingival margin has stabilized for 1 month during provisional restoration.[14]

For this 21-year-old female, the dental dimensions were first measured from the study model without waxing. The dental proportion calculation showed that the existing width between the central incisor and lateral incisor was larger than the width between the lateral incisor and canine on both sides. Our team had to determine the optimal target proportion and evaluated several proportional concepts.

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FIGURE 17. Comparison photos of pretreatment (left row) and follow-up after 6 months of treatment (right row).

The "golden proportion" is one of the most popular dental proportion theories in maxillary anterior teeth restoration. It is based on the relationship between natural beauty and mathematics. Based on this proportion, from the frontal view, the maxillary lateral incisor should be approximately 62% of the width of the maxillary central incisor, and the width of the maxillary canine should be approximately 62% of the width of the respective lateral incisor. The golden proportion is preferred in order to achieve an esthetic smile in the case of long maxillary central incisors.[9] On the other hand, Ufuk and colleagues (2005) found that there was no statistical significance in the golden ratio or any other continuous proportion for the anterior teeth in

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the population.[15] This was in agreement with Mahshid and colleagues (2004), who reported that the golden proportion was not observed in esthetic smiles.[16]

RED proportion is another concept of smile design based on a linear coefficient of progression: that is, the width of each successive tooth diminishes by the same proportion when viewed from the front. Ward (2007) stated that a 70% RED proportion is suitable for normal-length teeth with a 78% width/height ratio of the upper central incisors.[9] A survey by Basting and colleagues (2006) found that a proportional width between the maxillary central incisor and lateral incisor greater than 69.9% was esthetically acceptable, and the use of a 70% RED proportion was suggested.[7]

Rosenstiel and colleagues (2000) investigated the relationship between maxillary tooth height and the preferred RED proportion. The surveyed dentists preferred smiles with an 80% RED proportion when viewing very short teeth. For normal-length teeth, the dentists favored smiles with the central incisor corresponding to the 70% RED. For very tall teeth, the dentists favored smiles with the central incisor corresponding to the golden proportion (62% RED). For our patient's dental proportion improvement, re-generalization of tooth spacing by moving a few teeth prior to final restoration was achieved.[17]

Several methods can be used for minor tooth movement: for example, acrylic-and-wire appliances, fixed arch wires, an adhesive system for direct bonding, soft rubber tooth repositioning, and others.[10] For this case report, an acrylic-and-wire removable appliance was chosen for tooth movement. Because it is a relatively simple appliance, it can be installed and monitored by a general practitioner. Removable orthodontic appliances are suitable for minor tooth movement, with tipping force applied to the individual tooth.[18] Radiographs should be taken and analyzed before treatment to verify that the root position will not hinder tooth movement in the desired direction. This case is a good example of minor tooth movement using a removable appliance with spring. The initial position of the crown of tooth #10 was tipped distally due to the spaces between teeth #9/10 and teeth #10/11, whereas the root of the tooth angled toward the root of tooth #9. Wearing the appliance resulted in the crown of tooth #10 tipping back toward tooth #9. The keys to achieving optimal treatment results depended upon patient compliance and cooperation, and dentist's instruction.

After space redistribution had been completed, a second diagnostic wax-up was made and the dental proportion reevaluated. The wax-up model showed the anterior tooth proportion to be more harmonious. The width/height ratio of the central incisors was 0.82, and the proportion after space redistribution showed ratios ranging from 0.73 to 0.78 (73–78%).

Tooth whitening or tooth bleaching was performed to brighten tooth color. There are two major categories of vital tooth bleaching: power bleaching and home bleaching. In-office power bleaching provides the fastest result, with whiter teeth achieved in an hour. The most common tooth bleaching agent for power bleaching is hydrogen peroxide at concentrations of about 25 to 35%. These concentrations have the potential to cause soft tissue damage, so appropriate action to protect soft oral tissues during whitening must be taken. Home bleaching, on the other hand, involves custom-made bleaching trays and syringes containing a lower concentration of bleaching gel (10–20% carbamide peroxide). Home whitening tooth bleaching gels tend to be more viscous, pleasant-tasting, and contain a lower concentration of bleaching gel (hydrogen peroxide or carbamide peroxide at different concentrations, normally around 10–20%). For our patient, home bleaching was prescribed for 2 weeks. The procedure was discontinued when the expected result was obtained.

A 2-week waiting period after whitening was recommended before commencing resin composite bonding. Several previous investigations found a significant reduction in resin–enamel bonds on hydrogen peroxide- or carbamide peroxide-pretreated surfaces when the composite application was performed immediately after completing bleaching.[19,20] Residual oxygen from the bleaching agent on enamel surfaces may cause poor bond strength until time has reduced

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the peroxide concentrations within the bleached enamel.[21,22] The recommended time for resin composite to be restored onto carbamide peroxide-treated enamel ranged from 1 day to 3 weeks.[23,24]

Resin composite restoration is widely used for anterior dental restoration. The use of resin composite on the proximal surfaces to alter the crown anatomy is considered a more conventional and practical approach compared with full facial coverage porcelain veneers because tooth structure is preserved.[6,25] The technique for widening the teeth by resin composite approximal buildup uses a silicone matrix or template to build the enamel back wall, which results in a functionally correct palatal surface. The layering of dentin core, internal staining, and subsequent enamel layer can be applied on the enamel back wall created prior to using the silicone matrix. Another method uses provisional photopolymerizing plastic such as Fermit-N or Systemp.onlay (Ivoclar/Vivadent) to approximate the shape and fit of the transparent matrix. It can provide good contour and ensure that the material is applied more accurately.[26] Resin composite buildup restoration provides good physical properties and excellent esthetics at a lower cost. Because this type of treatment is a reversible procedure, it allows other treatment approaches that may be altered in the future.[6]

For restoration of peg lateral incisors, porcelain laminate veneers are more esthetic than direct or indirect composite veneers and are also considered to be a conservative approach. Only a small amount of enamel reduction on the labial surface is needed to create a definitive 0.5-mm subgingival margin and surface roughness. Direct composite veneers have shown a higher risk of failure compared with porcelain veneers at a 2.5-year evaluation.[27] The survival rate of 182 porcelain laminate veneers that were bonded using correct adhesive techniques was found to be 94.4% at 12 years.[28] Another study by Peumans and colleagues (2004) revealed an excellent retention rate of porcelain laminate veneers after 10 years, with only 4% of 87 veneers having to be replaced at follow-up. The esthetic result of ceramic veneers was good, with high patient satisfaction. The 4% of noted failures were found to possess microleakage, marginal discoloration, and fractures.[29] Regular professional care and patient instruction are the keys to ensure the longevity of porcelain laminate veneers and other direct composite restorations. Our patient was instructed to regularly floss after routine toothbrushing and to wear her retainers at night to maintain good positioning of her teeth. She was also advised to avoid chewing hard substances such as candies, ice, etc. and to refrain from habits such as fingernail biting that might cause damage to her restorations.

CONCLUSION

Treatment in esthetic cases often involves a multidisciplinary approach, such as orthodontic treatment, periodontal evaluation, oral surgery, restorative treatment, and prosthodontics. To achieve the desired esthetically pleasing treatment, smile analysis is essential. Dental plaster models provide three-dimensional source data, allowing dentists to examine the occlusion and the relation of the maxillary and mandibular dental arches. Dental photographs provide unlimited time to measure the dimensions and proportions of the teeth and are also important in dentist–lab technician communication. A diagnostic wax-up can display the desired treatment outcome and thus can be visualized by both the practitioner and the patient. Using dental proportion as a guideline in restoring the anterior maxillary teeth aids in achieving a more harmonized space distribution. This case was considered to be a good candidate for a sequence of multidisciplinary treatments involving very minimal preparation. Tooth preparation was done only for veneers on the peg lateral incisors. The patient was very satisfied with her new smile; the treatment also preserved as much of the original tooth structure as possible.

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REFERENCES

1. Academy of Prosthodontics. Glossary of prosthodontic terms. 7th ed. J Prosthet Dent 1999;81:48–110.
2. Bäckman B, Wahlin YB. Variations in number and morphology of permanent teeth in 7-year-old Swedish children. Int J Paediatr Dent 2001;11:11–7.
3. Kook Y, Park S, Sameshima GT. Peg-shaped and small lateral incisors not at higher risk for root resorption. Am J Orthod Dentofacial Orthop 2003;123:253–8.
4. Meskin LH, Gorlin RJ. Agenesis and peg-shaped permanent maxillary lateral incisors. J Dent Res 1963;42:1476–9.
5. Bello A, Jarvis RH. A review of esthetic alternatives for the restoration of anterior teeth. J Prosthet Dent 1997;78:437–40.
6. Ayca DI, Emrah A. Direct restorative treatment of peg-shaped maxillary lateral incisors with resin composite, a clinical report. J Prosthet Dent 2005;93:526–9.
7. Basting RT, Trindade RS, Flório FM. Comparative study of smile analysis by subjective and computerized methods. Oper Dent 2006;31:652–9.
8. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent 1973;29:358–82.
9. Ward DH. A study of dentists' preferred maxillary anterior tooth width proportions: comparing the recurring esthetic dental proportion to other mathematical and naturally occurring proportions. J Esthet Restor Dent 2007;19:324–39.
10. Geiger A, Hirschfeld L. Minor tooth movement in general practice. 3rd ed. St. Louis (MO): Mosby; 1974, pp. 1–129, 349–434.
11. Mack MR. Perspective of facial esthetics in dental treatment planning. J Prosthet Dent 1996;75:169–76.
12. Newman MG, Takei H, Klokkevold PR, Carranza FA. Carranza's clinical periodontology. 10th ed. Philadelphia (PA): Saunders; 2006, pp. 1044–5.
13. Pontoriero R, Carnevale G. Surgical crown lengthening: a 12-month clinical wound healing study. J Periodontol 2001;72:841–8.
14. Wise MD. Stability of the gingival crest after surgery and before anterior crown placement. J Prosthet Dent 1985;53:20–3.
15. Ufuk H, Semih B, Kerem A, Ilker A. An analysis of maxillary anterior teeth: facial and dental proportions. J Prosthet Dent 2005;94:530–8.
16. Mahshid M, Khoshvaghti A, Varshosaz M, Vallaei N. Evaluation of "golden proportion" in individuals with an esthetic smile. J Esthet Restor Dent 2004;16:185–93.
17. Rosenstiel SF, Ward DH, Rashid RG. Dentists' preferences of anterior tooth proportion—a web-based study. J Prosthodont 2000;9:123–36.
18. Singh G. Textbook of orthodontics. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers; 2007, pp. 421–48.
19. Titley KC, Torneck CD, Smith DC, Adibfar A. Adhesion of composite resin to bleached and unbleached bovine enamel. J Dent Res 1988;67:1523–8.
20. Stokes AN, Hood JA, Dhariwal D, Patel K. Effect of peroxide bleaches on resin-enamel bonds. Quintessence Int 1992;23:769–71.
21. Kalili T, Caputo AA, Mito R, et al. In vitro toothbrush abrasion and bond strength of bleached enamel. Pract Periodontics Aesthet Dent 1991;3:22–4.
22. Sung EC, Chan SM, Mito R, Caputo AA. Effect of carbamide peroxide bleaching on the shear bond strength of composite to dental bonding agent enhanced enamel. J Prosthet Dent 1999;82:595–9.
23. Dishman MV, Covey DA, Baughan LW. The effects of peroxide bleaching on composite to enamel bond strength. Dent Mater 1994;10:33–6.
24. Attin T, Hannig C, Wiegand A, Attin R. Effect of bleaching on restorative materials and restorations—a systematic review. Dent Mater 2004;20:852–61.
25. Heymann HO, Hershey HG. Use of composite resin for restorative and orthodontic correction for anterior dental spacing. J Prosthet Dent 1985;5:766–71.
26. Hugo B. Esthetics with resin composite: basics and techniques. New Malden, Surrey: Quintessence Publishing; 2009, pp. 47–56.
27. Meijering AC, Creugers NHJ, Roeters FJM, Mulder J. Survival of three types of veneer restorations in a clinical trial: a 2.5-year interim evaluation. J Dent 1998;26:563–8.
28. Fradeani M, Redemagni M, Corrado M. Porcelain laminate veneers: 6- to 12-year clinical evaluation—a retrospective study. Int J Periodontics Restorative Dent 2005;25:9–17.
29. Peumans M, De Munck J, Fieuws S, et al. A prospective ten-year clinical trial of porcelain veneers. J Adhes Dent 2004;6:65–76.

Reprint requests: Iyarint Ittipuriphat, DDS, PhD, Esthetic Restorative and Implant Dentistry, Faculty of Dentistry, Chulalongkorn University, 34 Henri-Dunant Rd., Patumwan, Bangkok 10330, Thailand; Tel.: 66-2218-8635; Fax: 66-2255-3058; email: iyarint@gmail.com
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