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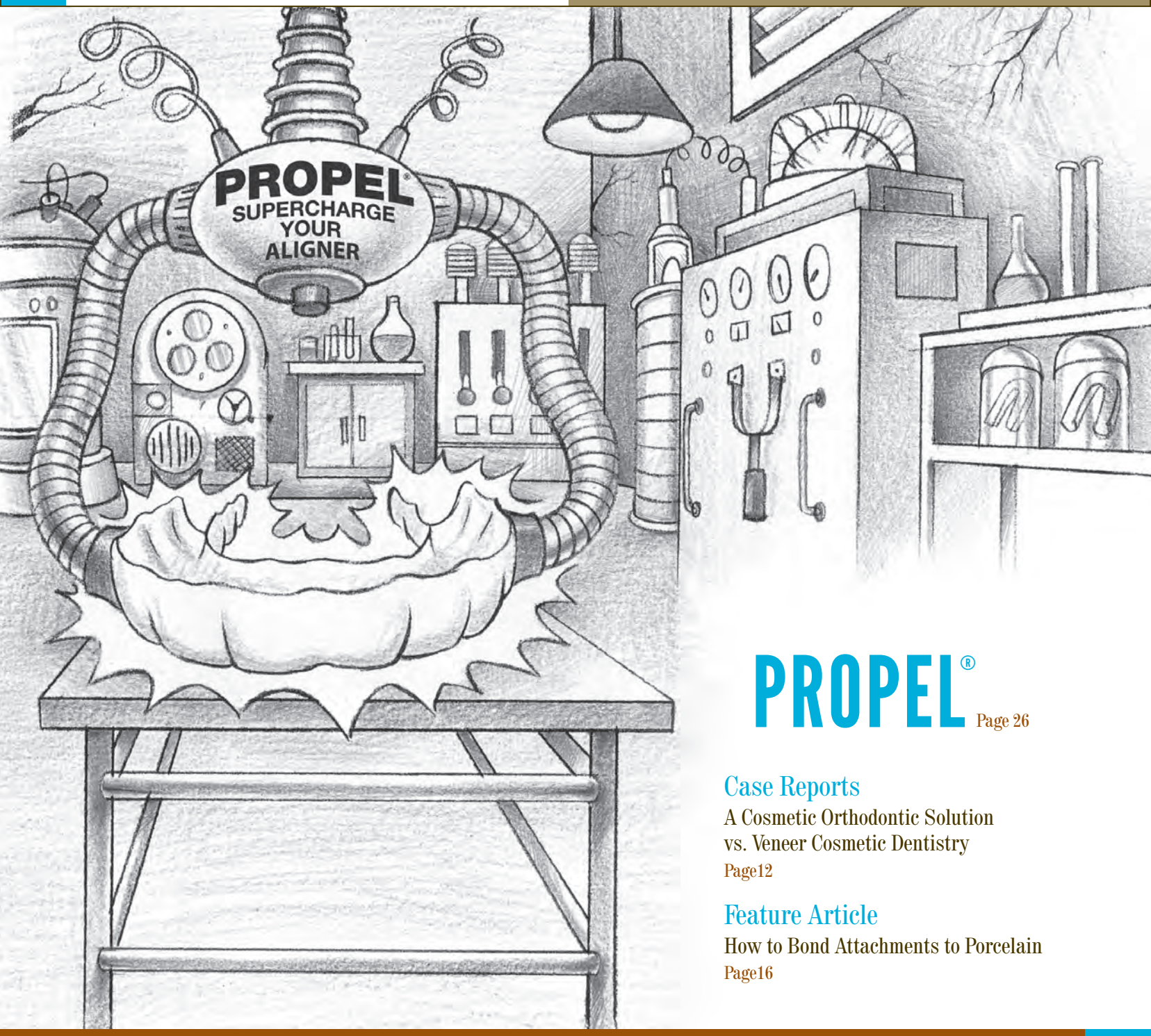

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Case Reports

A Smile Design Case Correcting Deep Overbite Using the Invisalign System

by Emil Hawary, DDS, FAACD, FAGD, DICOI

Abstract

Class II malocclusion presents a major and common challenge to orthodontists. Malocclusions treated with the Invisalign system initially involved only mild crowding of 3-6 mm; however, recently the system's use has expanded to incorporate the treatment of open bites, deep bites, and Class II and Class III cases. The present adult patient case report describes the smile design and correction of a deep-bite malocclusion, upper and lower crowding, and moderate tooth rotations treated with the Invisalign system.

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Introduction

Numerous orthodontic techniques and appliances have been introduced to address the challenge of correcting Class II malocclusions, including intra-arch and interarch appliances, extraoral appliances, selective extraction patterns, and surgical repositioning of the jaws.

The Invisalign system is based on a clear sequential appliance (aligner) made from a translucent thermoplastic material, which is worn for at least 20 hours per day.[1,2] According to current protocols, the aligners are replaced on a biweekly regimen which incorporates a progressive alignment of up to 0.25 mm translation or up to 2 degrees of rotation per tooth per aligner.

Aligners cause much less patient discomfort, compared to fixed appliances, in terms of mucosal irritation, soreness of the teeth, and several other areas of potential discomfort usually experienced during orthodontic treatment.[3]

Advantages of Clear Aligner Treatment also include the use of a computer plan as a virtual diagnostic setup, which helps in making the decision on the appropriate strategy to treat the patient.[4-7] The correction of deep overbite using Clear Aligner Treatment may present another advantage because of the more predictable nature of orthodontic intrusion mechanics and disclusion of the teeth, which eliminates problems from occlusal interferences encountered with fixed appliances.[8,9]

Malocclusions treated with the Invisalign system were initially restricted to cases of mild crowding of 3-6 mm.[10] Recent data have supported the expansion of the use of this system to incorporate molar distalization,[11] extraction cases,[12] the treatment of open bites,[13] crossbites,[10] deep bites,[14] Class II[11] and Class III corrections,[15] and orthodontic-periodontic problems.[16] Rotation is an orthodontic movement reported to be difficult to achieve and control with the Invisalign system.

Recently, many new biomechanical features have been promoted by Align Technology to improve the predictability of aligner treatment. In particular, the G3 and G4 platforms

Figure 1: pre-treatment extraoral views of profile, lip line, and smile line.

introduced a collection of newly engineered attachments to improve control of desired tooth movements, including dental rotation and root tipping.

Lip coverage of the maxillary incisors tends to increase with age, and therefore the percentage of high smiles may be greater among younger age groups[17,18] and smaller among older adults.[19] There is also a sex difference in smile type: low smile lines are a predominantly male characteristic, and high smile lines predominantly female.[20]

During orthodontic treatment of both routine and difficult cases, it is important to establish desirable characteristics of tooth display in rest position, normal conversation and full smile. Since parallelism of the maxillary incisal curve to the inner contour of the lower lip is the "normal" finding in untreated persons, it seems to be an optimal goal for objective beauty in all kinds of esthetic oral rehabilitations,[18,19] including orthodontic and orthodontic-prosthetic treatment.[21]

The present report describes a case of smile design for an adult patient, in whom the correction of a severe deep-bite malocclusion with moderate tooth rotations was successfully achieved with the Invisalign system.

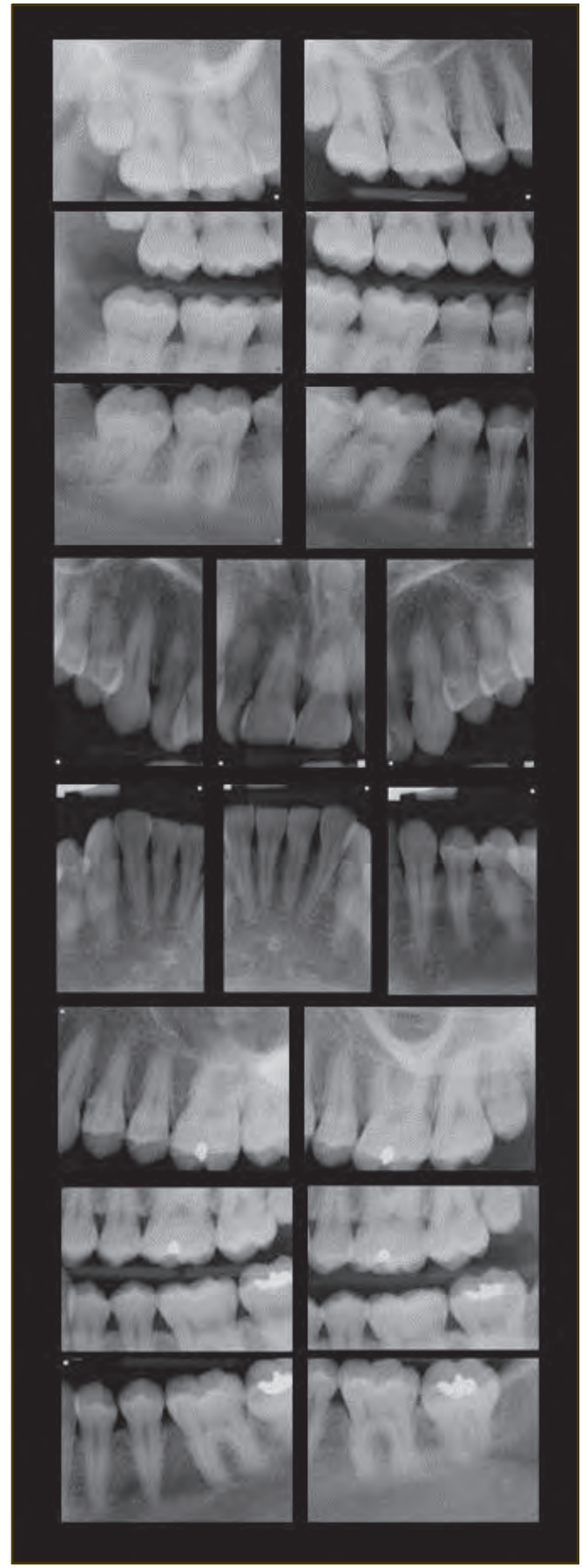

Figure 2: pre-treatment full-mouth radiographs.

Case study

A 27-year-old female patient presented to the office seeking to improve the appearance of her anterior teeth and enhance her smile. Her chief complaint was the overlapping of the upper laterals on the central incisors. The patient was also unhappy that too much of her lower incisors was showing and that she had a deep bite and a narrow smile (**Figure 1**). She wanted to have a symmetrical, attractive smile. She had no prior history of orthodontic treatment.

A comprehensive examination was performed, which included full-mouth radiographs (**Figure 2**), temporomandibular disorder (TMD) evaluations, mounted diagnostic models, intraoral and extraoral photos, and upper and lower arch impressions to generate a ClinCheck assessment.

Diagnosis

The clinical examination revealed a molar and cuspid Class II relationship, severe retroclination of the upper central incisors, mild rotations of the upper laterals and left cuspid, and mild lower crowding (**Figure 3**). The assessment of the temporomandibular joints revealed no symptoms of TMD.

Smile analysis involves analyzing a number of esthetic factors by observing the patient directly from the front.[22] The factors are: (1) crown lengths of maxillary and mandibular incisors; (2) incisal edge contours (before and after recontouring by grinding); (3) axial inclinations of all maxillary and mandibular incisors; (4) midlines (upper, lower, labial, and facial); (5) crown torque (canines, premolars, and molars on both sides); (6) smile line (rest position and full smile); and (7) right-left symmetry of crown shapes and sizes and gingival margin levels.

Smile analysis revealed that the patient's smile was not esthetically pleasing and violated a number of principles of the ideal smile design, as follows:

- Molar and cuspid Class II relationship
- Palatally inclined upper central incisors
- Overlapping of upper laterals on the centrals
- Deep bite
- Narrow buccal corridor resulting in a narrow smile
- Supereruption of lower anteriors

Different treatment options were presented to the patient, including orthodontic treatment with conventional fixed or removable appliances, and she opted to improve her smile using Invisalign aligners (because of their esthetic, removable nature), followed by in-office bleaching.

Invisalign treatment goals

As the patient's main complaint was esthetic, the purpose of the treatment was to improve her smile to a more pleasing appearance. Invisalign treatment goals were to:

1. Correct the deep bite by intruding and expanding the lower incisors
2. Correct the crowding of the upper and lower arches by controlled proclination of upper and lower incisors

Figure 3: intraoral photos at the beginning of treatment.

and expansion of upper central incisors, along with Interproximal Reduction (IPR) as needed
3. Expand the premolars for buccal corridor improvement
4. Improve the molars' and cuspids' Class II relationship
5. Correct the upper and lower midlines by moving the upper midline to the patient's left
6. Tip the incisors and level the Curve of Spee
7. Level maxillary gingival margins for esthetic and functional rehabilitation

Results

Patient compliance was high throughout treatment, and excellent oral hygiene was maintained.

Treatment was completed with the use of one set of 43 aligners. The total treatment time was approximately 2 years. The patient wore each set of aligners for a 2-week period. She was instructed to wear the aligners all the time, except during eating, drinking, and brushing. The patient presented to the office every 4 to 6 weeks for IPR and follow-up on the case. IPR allows the clinician to create room before the actual tooth movements in an otherwise constricted area, so that there is adequate space for the necessary tooth rotations.

Retention attachments were planned on several upper teeth (#4-13) and on several lower teeth (#20-29). Intermaxillary elastics were used to allow for movements and tipping of both maxillary and mandibular incisors as well as extrusion of mandibular molars. Treatment progress was checked every 4 weeks (2 aligners every month) using the ClinCheck analysis to evaluate changes, patient compliance, and bonded attachment stability.

Retention was accomplished with the use of upper and lower Vivera clear thermoplastic retainers.

At completion of treatment, vertical measurements of the maximum curve depth on the mandibular casts showed leveling of the Curve of Spee, which significantly reduced the overbite. The lower and upper anterior crowding and rotations were completely resolved, and the molar and canine Class II relationships were improved (**Figure 4**). The maxillary central incisors, laterals, and left canine as well as the lower anteriors were also uprighted successfully with the aligners.

The patient's periodontal health remained good and showed no deterioration from baseline. No obvious root resorption was radiographically evident at the end of treatment (**Figure 5**). The patient's teeth were bleached with the Zoom 2 whitening system (Discus Dental, Culver City, Calif.). The patient was very pleased with her new smile (**Figures 6 and 7**).

Discussion

The use of Invisalign aligners to successfully treat deep overbite problems (e.g., Class II Division 2 malocclusions) has been well documented.[23,24] Recent data support earlier clinical findings and report successful treatment of deep overbite with moderate to severe crowding in adults using Invisalign.[14]

Figure 4: intraoral photos at the end of treatment.

The case presented in this report demonstrates how the Invisalign system can be successfully used for effective bite-opening and elimination of rotations and crowding in the adult patient. This was accomplished by employing a concurrent Invisalign treatment strategy that involved extruding the posterior teeth while simultaneously intruding the anterior teeth.[25]

Invisalign is effective for treating deep overbite cases because of the predictability of the intrusion and leveling mechanics designed during the ClinCheck procedure.[26] Although the exact biomechanics are still not fully understood, Invisalign offers exceptional clinical outcomes with considerable patient and clinician satisfaction, as evidenced in this case report. The patient was afforded an esthetically pleasing, comfortable, and easy-to-use treatment experience with no compromise in efficacy or periodontal health.

In the presented case, correction of mild rotation of maxillary laterals and left cuspid as well as lower incisors was achieved with 43 sets of aligners over a period of 2 years, using accepted treatment protocols. This success may be due to the recent significant improvement in Invisalign technology, which has allowed the treatment of more difficult malocclusions over a relatively shorter time. The introduction of the G3 and G4 platforms with new SmartForce features has also potentially allowed more predictable tooth movement.

The maxillary incisors should be moved in the vertical direction that improves their relationship to the resting lip position, and the tooth-to-lip position should be monitored constantly throughout treatment. In some deep overbite cases, this may actually mean extrusion rather than intrusion of the maxillary incisors.[27,28] The best treatment strategy in the majority of deep overbite cases is to actively intrude the mandibular incisors.

Intermaxillary elastics, a typical interarch method used for Class II corrections, were employed in the presented case. The effects of Class II elastics include mesial movements of the mandibular molars, movements and tipping of the mandibular incisors, distal movements and tipping of the maxillary incisors, extrusion of the mandibular molars and maxillary incisors, and clockwise rotation of the mandibular and the occlusal planes.[29,30] Elastic wear is recommended from the start of treatment, continuing until the desired anterior-posterior correction has been achieved.

The use of 1-mm-thick (buccal-lingual dimension) horizontal beveled rectangular attachments is standard on premolars for retention of aligners during intrusive movements such as leveling the lower Curve of Spee in deep overbite, for extrusions, and for control of the tooth long axis during torquing movements.

Vig and Brundo[19] reported a gradual decrease in maxillary incisor exposure for each increase in age group from under 30 to over 60. Display of the maxillary incisors during normal conversation thus indicates youth, while display of only the

Figure 5: (A) initial and (B) final periapical radiographs (anterior region only). No obvious root resorption is present after treatment.

Figure 6: post-treatment; full face. Note the patient's attractive and symmetrical smile after orthodontic treatment.

Figure 7: (A) pre-treatment and (B) post-treatment; full smile. Note the attractive alignment of maxillary anterior teeth after using Invisalign.

mandibular incisors indicates old age. Generally, females have significantly more maxillary and less mandibular tooth exposure than males at all ages.

Parallelism of the incisal curve and the inner contour of the lower lip in smiling can readily be achieved if the maxillary central incisors are symmetrically positioned 0.5 mm-1.0 mm longer than the lateral incisors.[31]

Conclusion

Invisalign is a valuable and effective treatment option for Class II division 2 malocclusions. The presented case confirmed that the correction of a deep overbite and moderate tooth rotations in an adult patient can be achieved with Invisalign.■

References

1. Kuo E, Miller RJ. Automated custom-manufacturing technology in orthodontics. *Am J Orthod Dentofacial Orthop*. 2003 May;123(5):578-581.
2. Boyd RL, Vlaskalic V. Three-dimensional diagnosis and orthodontic treatment of complex malocclusions with the Invisalign appliance. *Semin Orthod*. 2001;7:274-293.
3. Miller KB, McGorray SP, Womack R, et al. A comparison of treatment impacts between Invisalign aligner and fixed appliance therapy during the first week of treatment. *Am J Orthod Dentofacial Orthop*. 2007 Mar;131(3):302.e1-9.
4. Boyd RL. Review of the diagnostic process. In: Tuncay O, ed. *The Invisalign System*. Chicago: Quintessence Publications; 2006:223-250.
5. Nelson G. Invisalign Summit '05, Part I. *Pacific Coast Soc Orthod Bull*. Winter 2005:6-8.
6. Boyd RL. Multidisciplinary considerations with Invisalign treatment for complex malocclusions. *Pacific Coast Soc Orthod Bull*. Spring 2006.
7. Nelson G. Invisalign Summit '05, Part II. *Pacific Coast Soc Orthod Bull*. Summer 2006:14-16.
8. Miller RJ, Derakhshan M. The Invisalign system: case report of a patient with deep bite, upper incisor flaring, and severe curve of Spee. *Semin Orthod*. 2002;8(1):43-50.
9. Boyd RL, Oh HS, Fallah M, Vlaskalic V. An update on present and future considerations of aligners. *J Calif Dent Assoc*. 2006 Oct;34(10):793-805.
10. Vlaskalic V, Boyd R. Orthodontic treatment of a mildly crowded malocclusion using the Invisalign system. *Aust Orthod J*. 2001 Mar;17(1):41-46.
11. Schupp W, Haubrich J, Neumann I. Class II correction with the Invisalign system. *J Clin Orthod*. 2010 Jan;44(1):28-35.
12. Womack WR. Four-premolar extraction treatment with Invisalign. *J Clin Orthod*. 2006 Aug;40(8):493-500.
13. Schupp W, Haubrich J, Neumann I. Treatment of anterior open bite with the Invisalign system. *J Clin Orthod*. 2010 Aug;44(8):501-507.
14. Giancotti A, Mampieri G, Greco M. Correction of deep bite in adults using the Invisalign system. *J Clin Orthod*. 2008 Dec;42(12):719-726.
15. Boyd RL. Surgical-orthodontic treatment of two skeletal Class III patients with Invisalign and fixed appliances. *J Clin Orthod*. 2005 Apr;39(4):245-258.
16. Turatti G, Womack R, Bracco P. Incisor intrusion with Invisalign treatment of an adult periodontal patient. *J Clin Orthod*. 2006 Mar;40(3):171-174.
17. Peck S, Peck L, Kataja M. The gingival smile line. *Angle Orthod*. 1992 Summer; 62(2):91-100.
18. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. *Am J Orthod Dentofacial Orthop*. 1992 Jun;101(6):519-524.
19. Vig RG, Brundo GC. The kinetics of anterior tooth display. *J Prosth Dent*. 1978 May;39(5):502-504.
20. Tjan AHL, Miller GD, The JGP. Some esthetic factors in a smile. *J Prosth Dent*. 1984 Jan;51(1):24-28.
21. Mack MR. Vertical dimension: a dynamic concept based on facial form and oropharyngeal function. *J Prosth Dent*. 1991 Oct;66(10):478-485.
22. Zachrisson BU. Esthetic factors involved in anterior tooth display and the smile: vertical dimension. *J Clin Orthod*. 1998 Sep;32(7):432-445.
23. Joffe L. Invisalign: early experiences. *J Orthod*. 2003 Dec;30(4):348-352.
24. Boyd RL. Esthetic orthodontic treatment using the Invisalign appliance for moderate to complex malocclusions. *J Dent Educ*. 2008 Aug;72(8):948-967.
25. Shroff B, Yoon WM, Lindauer SJ, Burstone CJ. Simultaneous intrusion and retraction using a three-piece base arch. *Angle Orthod*. 1997;67(6):455-462.
26. Boyd RL. Complex orthodontic treatment using a new protocol for the Invisalign appliance. *J Clin Orthod*. 2007 Sep;41(9):525-547.
27. Mackley RJ. An evaluation of smiles before and after orthodontic treatment. *Angle Orthod*. 1993 Fall;63(3):183-190.
28. Mackley RJ. "Animated" orthodontic treatment planning. *J Clin Orthod*. 1993 Jul;27(7):361-365.
29. Ellen EK, Schneider BJ, Sellke T. A comparative study of anchorage in bioprogressive versus standard edgewise treatment in Class II correction with intermaxillary elastic force. *Am J Orthod Dentofacial Orthop*. 1998 Oct;114(10):430-436.
30. Nelson B, Hansen K, Hägg U. Class II correction in patients treated with class II elastics and with fixed functional appliances: a comparative study. *Am J Orthod Dentofacial Orthop*. 2000 Aug;118(8):142-149.
31. Brisman AS. Esthetics: a comparison of dentists' and patients' concepts. *J Am Dent Assoc*. 1980 Mar;100(3):345-352.