

Treatment management between orthodontists and general practitioners performing clear aligner therapy

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ABSTRACT

Objective: To investigate differences in case selection, treatment management, and aligner treatment expertise between orthodontists and general practitioners.

Materials and Methods: A parallel pair of original surveys with three sections (case selection, treatment management, and demographics) was sent to orthodontists (N = 1000) and general dentists (N = 1000) who were providers of aligner treatment.

Results: Orthodontists had treated significantly more patients with aligners, had treated more patients with aligners in the previous 12 months, and had received more aligner training than general dentists ($P < .0001$). In general, case confidence increased with increasing experience for both orthodontists and general dentists. After adjusting for experience, there was a significant difference in aligner case confidence between orthodontists and general dentists for several malocclusions. General dentists were more confident than orthodontists in treating deep bite, severe crowding, and Class II malocclusions with aligners ($P \leq .0001$). Significant differences were also found for all treatment management techniques except interproximal reduction.

Conclusion: There was a significant difference in case selection, treatment management, and aligner expertise between orthodontists and general dentists, although the differences in case selection were small. Overall, it was shown that orthodontists and general dentists elected to treat a variety of moderate to severe malocclusions with aligners but with different utilization of recommended auxiliaries, perhaps demonstrating a difference in treatment goals. (*Angle Orthod.* 2017;87:432–439)

KEY WORDS: Aligner; Invisalign; Management

INTRODUCTION

As esthetic demands in society grow, more people have been seeking alternatives to fixed orthodontic appliances. Invisalign (Align Technology Inc, San Jose, Calif) is a popular aligner treatment that meets

this demand, sequentially moving teeth with removable clear aligners based on a series of computerized models. Both orthodontists and general dentists can treat any patient with Invisalign after completing the initial 1-day certification course, although a 2010 survey demonstrated that the majority of these providers did not feel confident in using Invisalign after initial certification.¹

The same 2010 survey also demonstrated that significant variations existed in case selection between orthodontists and general dentists performing aligner treatment.¹ Specifically, general dentists expressed that they would not use an aligner to treat a Class I malocclusion with a large diastema, while orthodontists said they would, and orthodontists would not treat a Class II patient with this treatment modality while general dentists would. In addition, neither group would use clear aligners to resolve severe crowding.

Selecting the proper malocclusions to treat with aligners is a critical therapeutic decision because studies have shown that aligners are able to correct some malocclusions successfully while others may

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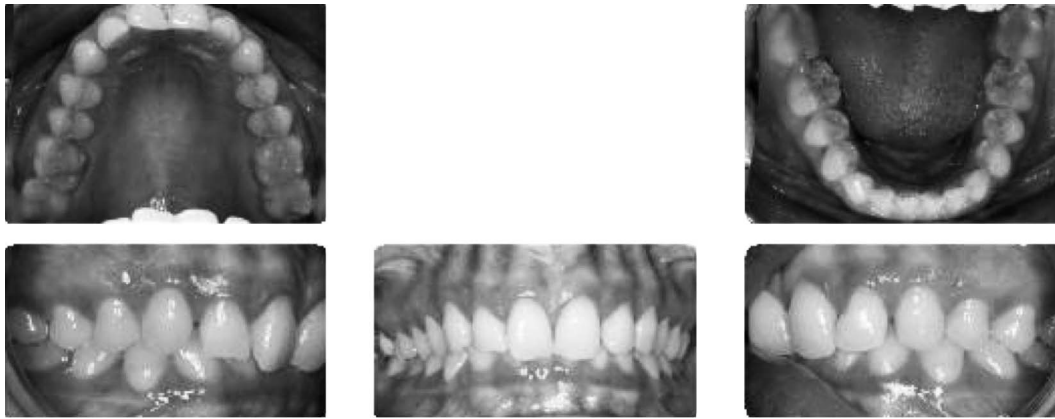


Figure 1. Patient 1 (deep bite).

pose a greater challenge. In 2009, Kravitz et al.² demonstrated that movements such as lingual constriction were more predictable, while others, such as extrusion, were less predictable. Since that study, however, Align Technology, Inc, has continued to develop new tools for the clear aligner system that presumably may challenge these parameters.

While research has shown that differences exist between orthodontists and general dentists regarding the use of clear aligners to treat patients with primarily Class I malocclusions, a comparison of case selection as it relates to treatment management techniques has not been conducted. In addition, no research has compared treatment management and aligner experience between the two groups of providers. Thus, the purposes of this study were (1) to determine how confident orthodontists and general dentists are in treating moderate to severe malocclusions with aligners to an ideal occlusion, (2) to explore differences in treatment management between the two groups, and (3) to compare and associate differences in aligner experience with the responses to the case selection and treatment management portions of the survey. The null hypothesis was that there is no difference in case confidence, treatment management, and aligner expertise between orthodontists and general dentists. Invisalign was chosen as a representative clear aligner therapy for this study.

MATERIALS AND METHODS

After approval from the Institutional Review Board of Virginia Commonwealth University, a parallel pair of original surveys was sent by mail to orthodontists (N = 1000) and general dentists (N = 1000) who were listed as Invisalign providers on the Invisalign website. A second mailing was sent out 6 weeks later to providers who did not respond to the first mailing. The survey consisted of three sections: case selection, treatment management, and background information. The case

selection portion asked participants to evaluate six unique patient presentations based on intraoral photographs (center, maxillary occlusal, mandibular occlusal, right buccal, and left buccal). Specifically, the survey asked orthodontists and dentists how confident they felt in treating each of the patients with Invisalign to an ideal occlusion on a scale of “very confident” (scored as +2) to “never treat this patient with Invisalign” (scored as -2).

Patient 1 (deep bite, Figure 1) displayed a Class I malocclusion with a deep 100% overbite, mild maxillary spacing, and mild mandibular crowding. Patient 2 (posterior crossbite, Figure 2) presented with a Class I malocclusion, 2-mm midline diastema, and a unilateral posterior crossbite. Patient 3 (mild crowding, Figure 3) demonstrated a Class I malocclusion with mild maxillary/mandibular crowding. Patient 4 (severe crowding, Figure 4) presented with severe maxillary/mandibular crowding and increased overjet. Patient 5 (anterior open bite, Figure 5) demonstrated a Class I malocclusion with an anterior open bite and mild maxillary/mandibular crowding. Patient 6 (Class II, Figure 6) demonstrated a Class II malocclusion with a deep bite and mild maxillary/mandibular crowding.

In the treatment management section of the questionnaire, providers were asked information about their typical protocols for treating patients with Invisalign, including techniques such as elastic use, interproximal reduction, and refinements. Lastly, the background section gathered information on practice demographics, Invisalign training, and orthodontic education of the doctors in the study.

All data were collected and recorded without identifiers and then analyzed. To determine whether there were significant differences in case confidence, treatment management, and Invisalign training between orthodontists and general dentists, χ^2 tests were used. We also looked for associations between confidence with Invisalign and specialty (orthodontists,



Figure 2. Patient 2 (posterior crossbite).

general dentists), while adjusting for various experience covariates (years in practice, hours of training, and number of patients treated). These associations were tested using linear models. All post hoc pairwise comparisons were performed using a Tukey-Kramer adjustment for multiple comparisons.

RESULTS

Responses were received from 374 orthodontists and 229 general dentists, for a response rate of 37% and 23%, respectively. There was no significant difference found in the number of years in practice between the groups and the respondents were representative of the true populations in practice for both orthodontists and general dentists. However, orthodontists reported treating significantly more active Invisalign® patients in the past 12 months ($P < .0001$), treating more total Invisalign® patients ($P < 0.0001$), receiving more hours of additional Invisalign® training ($P < 0.0001$), and attending the Invisalign® Summit more often ($P = 0.0003$) (Table 1).

Overall, both groups were relatively confident in treating all of the patients presented, except the patient

with severe crowding, as shown in Table 2. They were, on average, confident to very confident in treating patients with deep bite, posterior crossbite, and mild crowding; not confident in treating severe crowding, and neutral-confident in treating anterior open bite and Class II malocclusions. Table 3 displays which variables were statistically significantly associated with overall mean confidence for each patient. There was a significant difference in confidence between orthodontists and general dentists for four of the six patients (deep bite, mild crowding, severe crowding, and Class II). Specifically, general dentists were more confident treating deep bite ($P = .0001$), severe crowding ($P < .0001$), and Class II malocclusions ($P < .0001$) with Invisalign, while orthodontists were more confident than general dentists treating mild crowding ($P = .0019$). The association between years in practice and confidence varied, with statistically relevant associations only for patients with a deep bite and a Class II malocclusion. For all of the patients presented, confidence was significantly associated with the total number of patients treated by the surveyed Invisalign providers. Finally, training hours were significantly

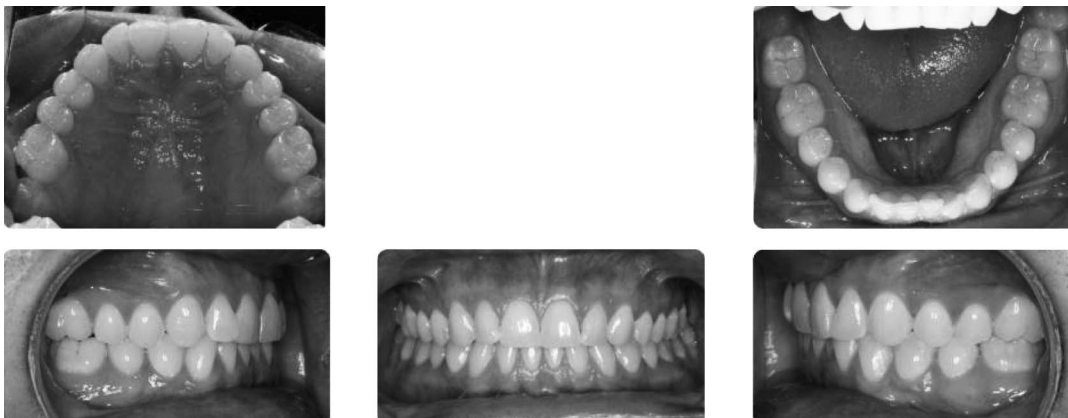


Figure 3. Patient 3 (mild crowding).

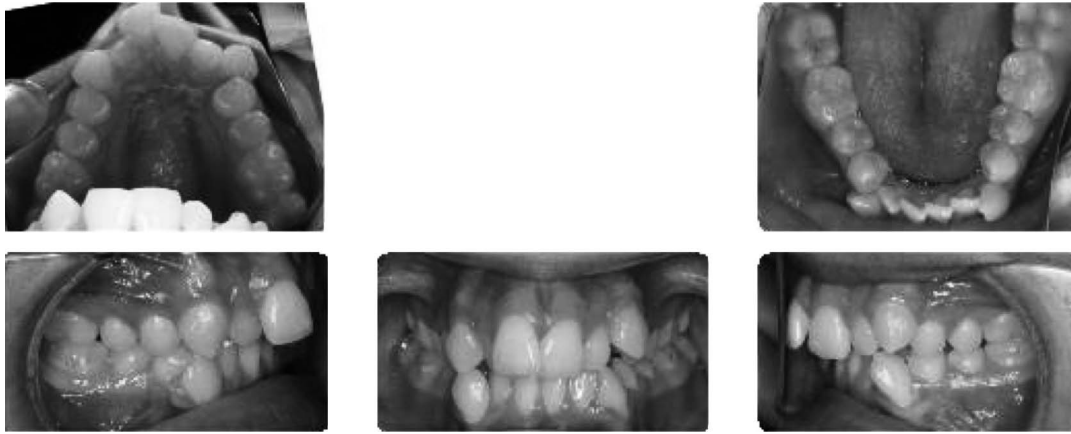


Figure 4. Patient 4 (severe crowding).

associated with confidence treating posterior crossbite, severe crowding, anterior open bite, and Class II malocclusion.

In the treatment management portion of the survey, no significant difference was found in the use of interproximal reduction between orthodontists and general dentists ($P = .1502$). However, significant differences were found for the use of all remaining auxiliaries and supplemental techniques (Table 4). Of note, orthodontists were significantly more likely to spend a longer time reviewing the ClinCheck and more likely to do refinements ($P \leq .0081$). Orthodontists were more likely to prescribe all types of elastics ($P < .0001$). Specifically, 92% of orthodontists reported the use of Class II elastics compared with 37% of dentists. They were also more likely to prescribe extractions ($P = .0003$) and to use a combination of fixed appliances and Invisalign ($P < .0001$).

Regarding patient consultations, orthodontists were more likely to tell patients that their malocclusion was too complex for Invisalign ($P < .0001$) and more likely to believe treatment outcomes would have been

improved if their patients had been treated with conventional braces instead of Invisalign ($P < .0001$).

DISCUSSION

Overall, orthodontists reported significantly more Invisalign experience than general dentists. Variations in case confidence between the specialties were found for deep bite, mild crowding, severe crowding, and Class II malocclusions, after adjusting for experience. However, these differences were small, and the overall trend seemed to be that general dentists and orthodontists were selecting Invisalign cases with similar confidence yet using different auxiliaries and supplemental techniques. Of note, respondents were free to interpret the word “confidence” as they saw fit. It was assumed that when providers reported being confident treating a given patient, they were aiming for an ideal finish as defined by the American Board of Orthodontics, but this may not have been true.

No statistically significant difference in confidence between orthodontists and general practitioners was found in treating patients with posterior crossbite or



Figure 5. Patient 5 (anterior open bite).



Figure 6. Patient 6 (Class II malocclusion).

anterior open bite. According to et al.,³ crossbites can be effectively corrected by clear aligners because they disocclude the teeth, although they advised that crossbites of skeletal origin should be treated by orthopedic or surgical means. In addition, aligners have been suggested as a viable and even preferable alternative to fixed appliances for the treatment of anterior open bites because the double thickness of the aligners, in combination with the patient's biting force, intrudes the posterior teeth and thus aids in bite closure.⁴ Both orthodontists and general practitioners were confident treating these two malocclusions with Invisalign, possibly because they may have witnessed the success of disocclusion and posterior intrusion with aligners as they had treated more patients and had received more training.

Orthodontists and general dentists were also confident treating mild crowding, although orthodontists were slightly more so. All orthodontic respondents reported that they were confident or very confident, while a very small percentage of general dentists reported that they were neutral, not confident, or would never treat this patient with Invisalign. Possibly, some general dentists may have thought treatment was unnecessary, or they may have felt they could not meet the patient's esthetic demands. To support this hypothesis, one free-form comment from a general dentist stated "Does this case need treatment?" Orthodontists, on the other hand, may have been more comfortable using appliances such as aligners to move teeth as well as more aware of discrepancies in alignment due to their additional specialty training. They reported adding auxiliaries more often, such as precision cuts for elastics and lingual attachments for teeth that were not tracking. Overall, orthodontists said they spent more time reviewing the ClinCheck and were more likely to do refinements, suggesting that they many have had

different goals for the patients they were treating than the general dentists who did not report making as many changes to the ClinCheck.

General dentists were marginally more confident using Invisalign to treat patients with a deep bite than orthodontists with similar experience, but they were significantly less likely to use auxiliaries, such as vertical elastics, to aid in posterior extrusion compared with orthodontists. Orthodontists may have

Table 1. Respondent Demographics

	General Dentist	Orthodontist	<i>P</i> Value (χ^2)*
How many years have you been practicing?			
1–10 y	21%	23%	.95
11–20 y	30%	27%	
21–30 y	28%	29%	
31–40 y	15%	15%	
More than 40 y	6%	6%	
How many active patients have you treated with Invisalign in the past 12 months?			
0–9	13%	2%	<.0001*
10–49	72%	47%	
50–99	11%	24%	
100–199	3%	20%	
200 or more	3%	8%	
How many patients have you treated with Invisalign in total?			
0–9	0%	1%	<.0001*
10–49	26%	7%	
50–299	64%	45%	
300–799	7%	33%	
800 or more	3%	16%	
How many hours of additional training pertaining to Invisalign have you received after initial certification?			
0–5 h	11%	7%	.0003*
6–10 h	18%	9%	
11–15 h	16%	13%	
More than 15 h	56%	72%	
Did you attend an Invisalign Summit?			
Yes	18%	47%	<.0001*

* *P* = .05.

Table 2. Mean Confidence Rating for Each type of Malocclusion

Patient	Mean ^a	Likert Scale
Patient 1: Deep bite	1.376451	Confident-Very Confident
Patient 2: Posterior crossbite	1.195688	Confident-Very Confident
Patient 3: Mild crowding	1.800995	Confident-Very Confident
Patient 4: Severe crowding	-0.50498	Not Confident-Neutral
Patient 5: Anterior open bite	0.48505	Neutral-Confident
Patient 6: Class II	0.681208	Neutral-Confident

^a Very confident = +2, confident = -1, neutral = 0, not confident = -1, never treat this patient with Invisalign = -2.

been more aware that vertical tooth movements have been shown to be difficult to achieve with aligners.⁵ Forces required for intrusion of incisors are higher than those for extrusion, regardless of the type of appliance, and the use of Invisalign presents an additional challenge since a previous study found the mean accuracy of tooth intrusion to be 41.3% when the average amount of intrusion attempted was 0.72 mm.² Thus, the slightly higher confidence of general dentists in treating deep bite without the use of auxiliaries may indicate that they were not aiming to reduce the overbite to ideal as one of their treatment objectives.

General dentists were also more confident treating severe crowding than orthodontists, but orthodontists were more likely to prescribe extractions, to prescribe all types of elastics, and to use a combination of fixed appliances and Invisalign. If patients with severe crowding were treated without extractions, it would require significant arch expansion and proclination of the teeth beyond what is generally considered to be stable and periodontally healthy. If extractions were used, an understanding of the proper moment to force ratios needed during treatment would be critical to its stability and success since teeth⁶ tend to tip into extraction spaces, the bite deepens as space is closed, and anchorage control is critical.⁷ Orthodontists are more aware of how to handle the biomechanical challenges of such clinical situations. Thus, as the survey responses reflected, they seemed to be more comfortable prescribing elastics with Invisalign and preferred using fixed appliances to achieve bodily tooth movement during space closure, especially since root parallelism is a limitation of Invisalign treatment.⁸

Finally, to achieve an ideal Class I molar relationship for the patient presenting with a Class II malocclusion, Class II elastics⁹ or an alternative noncompliant device with fixed appliances or clear aligners would typically be utilized.^{10,11} According to Djeu et al. in 2005,¹² Invisalign received poorer scores

Table 3. Model Results for Case Selection

	P Value*			
	Specialty	Years in Practice	Number of Patients	Training Hours
Patient 1: Deep bite	.0001 ^a	.028 ^a	.0032 ^a	.5219
Patient 2: Posterior crossbite	.0829	.0836	<.0001 ^a	.0061 ^a
Patient 3: Mild crowding	.0019 ^a	.1821	.0049 ^a	.0642
Patient 4: Severe crowding	<.0001 ^a	.0706	<.0001 ^a	<.0001 ^a
Patient 5: Anterior open bite	.6571	.3796	<.0001 ^a	<.0001 ^a
Patient 6: Class II	<.0001 ^a	.0044 ^a	<.0001 ^a	.006 ^a

* $P = .05$.

^a Statistically significant association with overall mean confidence ($P < .05$).

using the America Board of Orthodontics objective grading system for large anteroposterior corrections compared with conventional braces. However, since the results of that study were published, Align Technology introduced Invisalign G3 with Precision Cuts to accommodate the use of elastics for anteroposterior correction.

Similar to the patient with severe crowding, general dentists were significantly more willing to treat a Class II malocclusion compared with orthodontists, although they were significantly less likely to use Class II elastics (37% vs 92%). Alternatively, several orthodontists noted in a free-form comment that they were confident treating the patient, but they would not correct the Class II relationship. Others mentioned that they would use a fixed appliance, such as a molar distalizer, before beginning treatment to achieve a Class I relationship first. This hesitation to treat a Class II malocclusion with Invisalign may have been due to orthodontists' experience with conventional braces. Research has shown that treating a patient with Class II division 1 malocclusion can take an average of 5 months longer than treating a Class I malocclusion,¹³ and that treatment time may be influenced by a variety of factors, including the type of Class II corrector used, number of months of elastic wear, compliance, and average time between appointments.¹⁴

Since general dentists were more confident treating Class II malocclusions than orthodontists, but less likely to use elastics, it seems that most were not aiming to alter the molar and canine classification. Vicéns and Russo,¹ who also found that general dentists were more likely to treat a Class II discrepancy in their study, hypothesized that they may have had different treatment objectives as a result of their varied educational background. In other words, general dentists who treat Class II malocclusions with aligners

Table 4. Treatment Management by Specialty

	% Usage		P Value (χ^2)
	Orthodontist	General Dentist	
Interarch elastics	93%	41%	<.0001
Class II	92%	37%	<.0001
Class III	82%	16%	<.0001
Crossbite	41%	10%	<.0001
Vertical or Box	44%	11%	<.0001
Extractions	65%	50%	.0003
Combination of fixed/Invisalign	78%	23%	<.0001
How often do you use refinements?			<.0001
Never	0%	0%	
0%–25% of patients	9%	27%	
26%–50% of patients	22%	35%	
51%–75% of patients	27%	21%	
More than 75% of patients	42%	17%	
Time reviewing/changing ClinCheck			.0081
Usually make no changes	1%	3%	
0–15 min	37%	44%	
16–30 min	41%	37%	
31–45 min	17%	9%	
45 min	5%	7%	
How often do you tell a patient that his or her case is too complex for Invisalign?			<.0001
Less than 25%	58%	80%	
26%–50%	31%	17%	
51%–75%	8%	1%	
75%	3%	1%	
What percent of patients would have had better outcomes with conventional braces?			<.0001
Less than 25%	65%	87%	
26%–50%	17%	7%	
51%–75%	11%	3%	
75%	7%	2%	

* $P = .05$.

but without the auxiliaries necessary for classification correction may be aiming primarily for esthetic alignment. Orthodontists, on the other hand, may be more focused on occlusion in addition to alignment, and so their treatment objectives may have resulted in the decreased confidence demonstrated for treating a Class II malocclusion.

While the orthodontists responding to the survey had more overall experience using Invisalign to treat patients, they were also significantly more likely to tell patients their malocclusion was too complex for clear aligners. In addition, they were more likely to believe better treatment outcomes could have been achieved if fixed appliances were used instead of clear aligners. As specialists, orthodontists may be more critical of tooth position as well as more comfortable correcting malalignment with brackets, wires, and appliances. Alternatively, general dentists may not be as focused on the same details as orthodontists, or they may not know what can be

accomplished using fixed appliances due to lack of experience.

The results of this study showed that both orthodontists and general dentists are electing to treat a variety of moderate to severe malocclusions with aligners, but there are differences in case confidence, treatment management, and expertise. More studies are needed to establish strengths and limitations of treatment with aligners as methods and materials continue to evolve. More training is indicated to ensure that providers are confident and successful in treating diverse patient pools.

CONCLUSIONS

- Among Invisalign providers, orthodontists had treated significantly more total patients, had treated more patients in the previous 12 months, and had received more training than general dentists.
- General dentists were more willing to treat more complex malocclusions with Invisalign, such as deep bite, severe crowding, and Class II malocclusions. Orthodontists were more likely to tell patients that their occlusion was too complex for Invisalign.
- General dentists were also less likely to use interarch elastics and other auxiliary techniques, and they spent less time modifying the patient's treatment plan on the ClinCheck, presumably owing to lower treatment objectives.
- Orthodontists were more likely to perceive that better outcomes could be achieved for their patients with fixed appliances versus Invisalign.
- In summary, general dentists were more willing to treat more complex malocclusions with Invisalign, spend less time on the patient's digital treatment plan, and use fewer auxiliaries during treatment, perhaps demonstrating a difference in treatment goals.

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REFERENCES

1. Vicéns J, Russo A. Comparative use of Invisalign by orthodontists and general practitioners. *Angle Orthod.* 2010;80:425–434.
2. Kravitz ND, Kusnoto B, BeGole E, Obrez A, Agran B. How well does Invisalign work? A prospective clinical study evaluating the efficacy of tooth movement with Invisalign. *Am J Orthod Dentofacial Orthop.* 2009;135:27–35.
3. Boyd RL, Oh H, Fallah M, Vlaskalic V. An update on present and future considerations of aligners. *J Calif Dent.* 2006;34:793–805.

4. Boyd RL. Complex orthodontic treatment using a new protocol for the Invisalign appliance. *J Clin Orthod.* 2007;41:525–547.
5. Krieger E, Seiferth J, Marinello I, et al. Invisalign treatment in the anterior region: were the predicted tooth movements achieved? *J Orofac Orthopod.* 2012;73:365–376.
6. Baldwin DK, King G, Ramway DS, Huang G, Bollen AM. Activation time and material stiffness of sequential removable orthodontic appliance. Part 3: premolar extraction patients. *Am J Orthod Dentofacial Orthop.* 2008;133:837–845.
7. Giancotti A, di Girolamo R. Treatment of severe maxillary crowding using Invisalign and fixed appliances. *J Clin Orthod.* 2009;43:583–589.
8. Womack W, Ahn J, Ammari Z, Castillo A. A new approach to correction of crowding. *Am J Orthod Dentofacial Orthop.* 2002;122:310–316.
9. Boyd RL. Esthetic orthodontic treatment using the Invisalign appliance for moderate to complex malocclusions. *J Dent Educ.* 2008;72:948–967.
10. Bowman SJ, Celenza F, Sparaga J, Papadopoulos MA, Ojima K, Lin JC. Creative adjuncts for clear aligners: part I Class II treatment. *J Clin Orthod.* 2015;49:83–94.
11. Eckhart JE. Sequential MARA-Invisalign treatment. *J Clin Orthod.* 2009;43:439–448.
12. Djeu G, Shelton C, Maganzini A. Outcome assessment of Invisalign and traditional orthodontic treatment compared with the American Board of Orthodontics Objective Grading System. *Am J Orthod Dentofacial Orthop.* 2005;128:292–298.
13. Vig K, Weyent R, Vayda D, O'Brien K, Bennett E. Orthodontic process and outcome: efficacy studies—strategies for developing process and outcome measures: a new era in orthodontics. *Clin Orthod Res.* 1998;1:147–155.
14. Popowich K, Nebbe B, Heo G, Glover K, Major P. Predictors for Class II treatment duration. *Am J Orthod Dentofacial Orthop.* 2005;127:293–300.