

A Patient-Classification System for Invisalign Cases

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The Invisalign system* offers many advantages over fixed appliances, including gentler tooth movement, fewer office visits, improved esthetics, and easier oral hygiene. Appropriate case selection is important, however, to assure optimal results. Although any orthodontist is required to take a certification course before beginning to treat patients with Invisalign, this course touches only briefly on case selection.

When fixed appliances are used to correct crowding, there is no difference in complexity among in/out movements, rotations, extrusions/intrusions, torquing, and root tipping. In contrast, with Invisalign treatment, some tooth movements are more complex than others. In/out movements, including space closure and arch expansion, are relatively predictable. Rotational movements are somewhat more difficult, although incisor rotations are more reliable than canine or premolar rotations. Next on the spectrum of complexity are vertical movements. Mild open bites of -1mm to 2mm and mild deep bites of 4-6mm present moderate difficulty; more severe open bites and deep bites can be extremely problematic. The most difficult tasks to achieve with the Invisalign technique are root movements, especially torquing and root paralleling.¹ As the complexity level increases, so do the number of aligners needed, the length of treatment, the necessity of midcourse corrections and case refinements, and the chances of needing fixed appliances to complete treatment.

A classification system establishing the level of complexity of Invisalign treatment could help the orthodontist decide whether to treat a given patient with Invisalign or with fixed appliances.

Such a system could also facilitate Invisalign treatment planning and help determine appropriate fees. This article presents a classification involving four levels of complexity, based on factors unique to the treatment of Invisalign cases. In addition, we report on a study of 281 Invisalign patients treated in one orthodontic office, showing how the classification can affect the number of aligners used, the number of office visits, the number of emergencies, and the frequency of midcourse corrections.

Study Results

The following information was collected for 281 consecutive Invisalign patients who had completed treatment in a single orthodontic office and were at least one year into retention:

- Level of complexity (see following pages)
- Fee charged
- Number of aligners used
- Number of office visits needed to complete treatment
- Number of office visits needed for midcourse correction/refinement
- Number of office visits needed for fixed appliances (if used)
- Number of emergencies
- Number of office visits during retention
- Patient age (teen/adult)
- Patient sex

As expected, the majority of treated cases (65%) were classified as Level 1 or 2, which reflects the growing predictability of Invisalign therapy for space closure, arch expansion, and correction of crowding by means of in/out tooth movements (Fig. 1). The average number of align-

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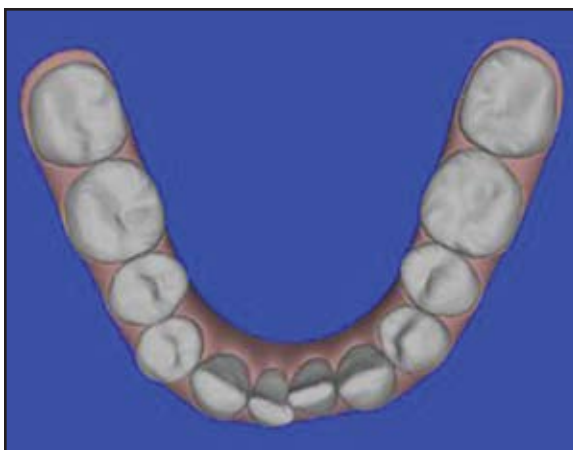
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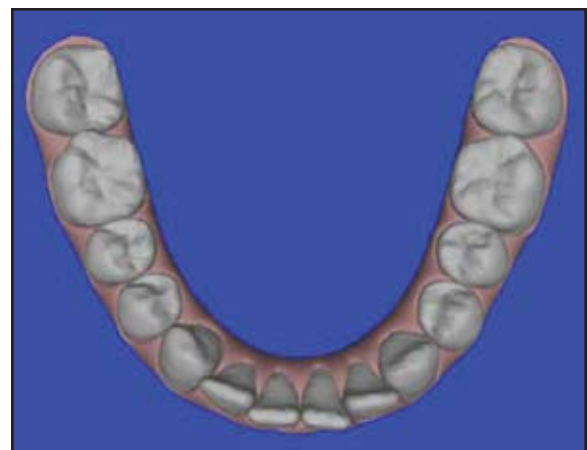
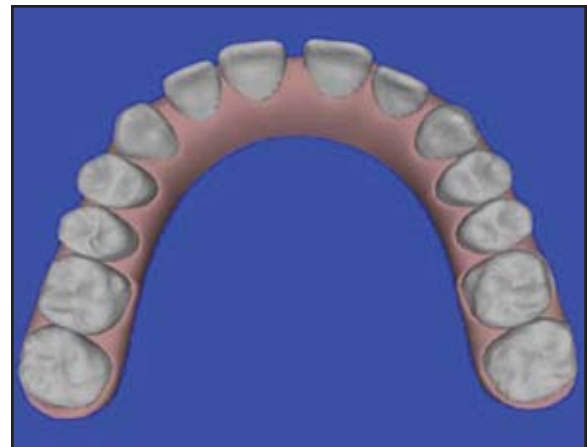


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Level 1: "Invisalign Express"; 10 or fewer aligners needed.

- Spacing: minor anterior
- Crowding: minor in/out movements, expansion, minor interproximal reduction (IPR)
- Minimal rotations, involving incisors only (<math><10^\circ</math>)
- No vertical movements
- Class I molar/canine occlusion
- No extractions



Level 2: 10-20 aligners needed.

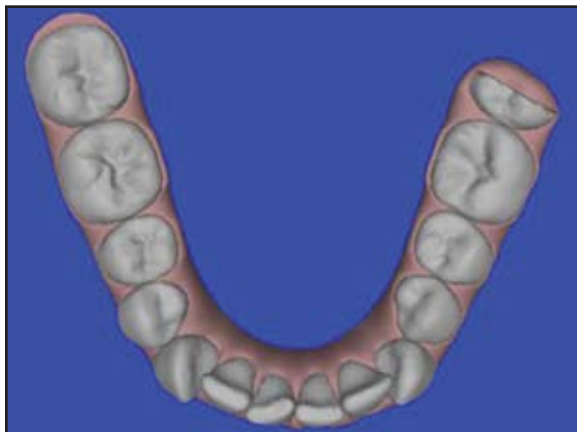
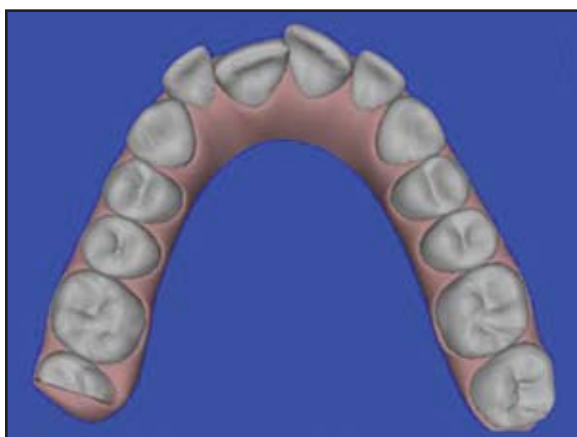
- Space closure: moderate anterior/posterior
- Crowding: moderate in/out movements, buccal expansion, minor IPR
- Minor rotations, including canines/premolars (5-15°)
- Minimal extrusive/intrusive vertical movements (1-2mm)
- Class I molar/canine occlusion
- No extractions

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ers increased dramatically with the level of complexity, confirming the validity of the classification system (Fig. 2). The majority of Invisalign patients (78%) experienced no emergencies, and the frequency of emergencies increased only slightly with the complexity of the case (Fig. 3).

The average number of office visits needed

to complete treatment also increased with the complexity level (Fig. 4). The number of visits recorded did not include the initial examination, records appointments, or retention visits, but did include any visits needed for emergencies, mid-course corrections or refinements, or fixed appliance therapy.



Level 3: 15-30 aligners needed.

- Crowding: buccal expansion, moderate-to-extensive IPR
- Moderate rotations, including canines/premolars ($>15^\circ$)
- Moderate vertical movements (3-4mm)
- Class I molar/canine occlusion
- No extractions
- Molar uprighting



Level 4: More than 30 aligners needed.

- Class II or III occlusion (including end-on)
- Crowding requiring extractions (including incisors)
- Substantial vertical movements (more than 4mm)
- Crossbite (anterior/posterior)
- Presurgical setup
- Substantial root movement: torquing, root preparation for restorative procedures

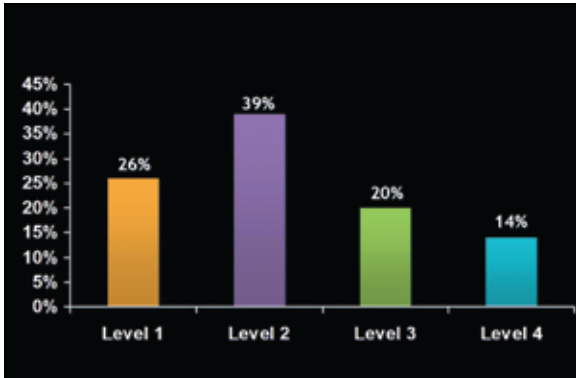


Fig. 1 Distribution of Invisalign case complexity levels.

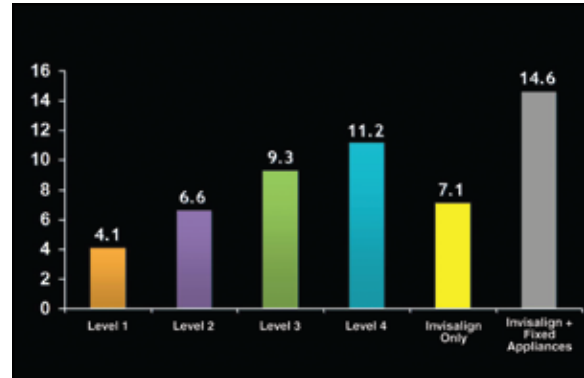


Fig. 4 Average total number of visits by complexity level.

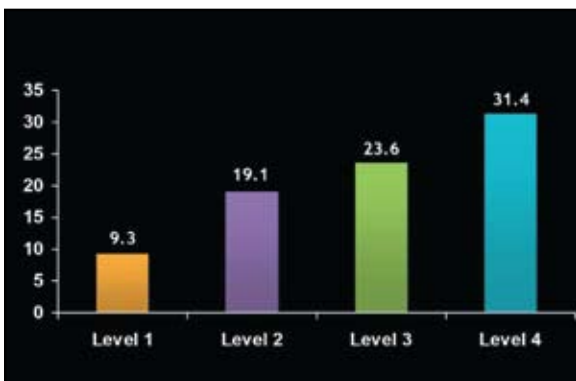


Fig. 2 Average number of aligners used by complexity level.

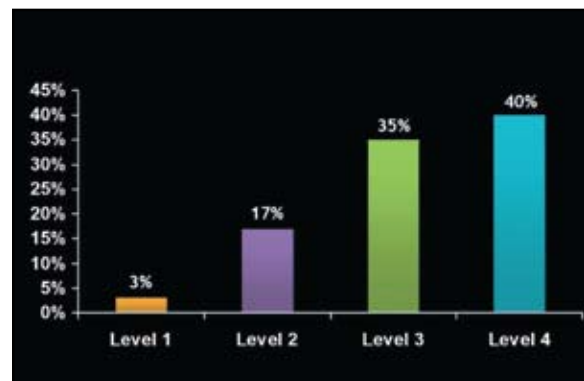


Fig. 5 Percentage of patients requiring midcourse corrections by complexity level.

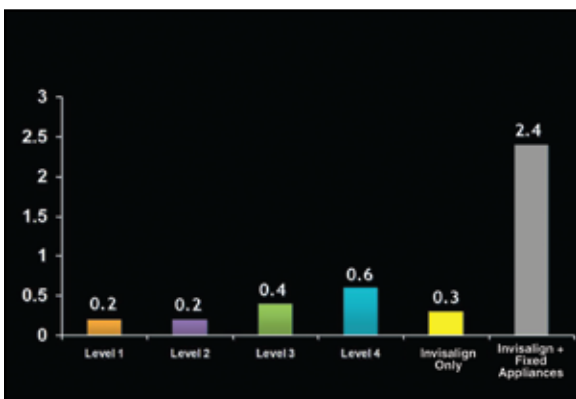


Fig. 3 Average number of emergencies by complexity level.

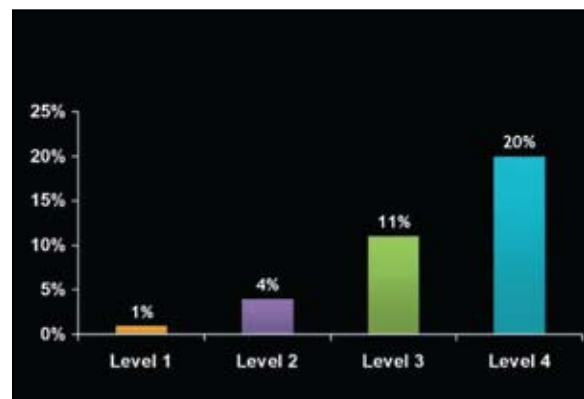


Fig. 6 Percentage of patients requiring fixed appliances by complexity level.

The percentage of cases requiring midcourse correction or refinement (Fig. 5) and fixed appliance treatment (Fig. 6) both increased dramatically with case complexity. In cases needing midcourse correction, the average number of extra office visits required for this purpose rose from three visits for Level 1 cases to three and a half visits for Level 2 cases, five visits for Level 3 cases, and four visits for Level 4 cases. Similarly, in cases requiring some treatment with fixed appliances, the average number of extra office visits increased steadily from four visits for Level 1 cases to five visits for Level 2 cases, seven visits for Level 3 cases, and eight visits for Level 4 cases.

Invisalign treatment is still used mainly in adult patients (81% of the Invisalign patients in this study). In our sample, Invisalign treatment of teen-age patients was largely restricted to Levels 1 and 2, with teen-agers accounting for 24% and 25% of these cases, respectively, compared with 7% and 12% of Level 3 and 4 cases, respectively. Given the recent launch of the Invisalign Teen system, such demographics are likely to change. The availability of compliance indicators, Power Ridge* technology for maxillary incisor torque,

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and eruption predictors will probably increase the proportion of teen-age Invisalign patients in most practices.

While 57% of the Invisalign patients in the study and most of the Level 1 and 2 patients (76% and 56%, respectively) were female, most of the Level 3 and 4 patients were male (54% and 58%, respectively). This may indicate a greater resistance on the part of male patients to the use of fixed appliances.

Conclusion

The Invisalign patient-classification system presented here can aid in case selection and treatment planning, as well as in setting fees, since greater case complexity has been shown to be associated with more office visits and thus increased costs. Future studies will compare Invisalign treatment with fixed appliances in terms of number of office visits, number of emergencies, patient sex and age, and profitability.

REFERENCES

1. Joffe, L.: Invisalign: Early experiences, *J. Orthod.* 30:348-352, 2003.