RESEARCH PAPER

Evaluation of predictability of tooth movement using different aligner brand: A prospective clinical study

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Abstract
To evaluate the predictability of orthodontic tooth movement using different clear aligner brands through a secondary-data synthesis of published clinical evidence available up to 2025. A secondary-data-based comparative clinical evidence study was conducted using published clinical studies and systematic reviews that evaluated planned versus achieved orthodontic tooth movement with clear aligners. The main multi-brand dataset was extracted from a 2025 longitudinal clinical study comparing Angel Aligners, Invisalign, Spark, and HeySmile in adult patients requiring dentoalveolar expansion. Additional movement-specific data were extracted from published studies on Invisalign and other clear aligner systems. Predictability was defined as the percentage of clinically achieved movement relative to planned digital movement.
In the 2025 multi-brand adult expansion study, Angel Aligner showed the highest overall predictability at **60.002%**, followed by HeySmile **59.895%**, Spark **59.275%**, and Invisalign **57.153%**. Lower-arch expansion was more predictable than upper-arch expansion. Tooth-group analysis showed the highest predictability for second bicuspids, followed by first bicuspids, first molars, and canines. Earlier Invisalign evidence reported mean overall tooth movement accuracy of **41%** in 2009 and approximately **50%** in 2020. Extrusion, canine rotation, premolar derotation, torque, and mandibular incisor intrusion were among the least predictable movements, whereas molar distalization and selected transverse expansion movements showed comparatively higher predictability.
Clear aligner predictability remains moderate and varies according to aligner brand, arch, tooth group, and movement type. Brand-level differences were observed for dentoalveolar expansion, although the evidence is stronger for Invisalign than for newer aligner systems. Clinicians should apply overcorrection, optimized attachments, careful staging, auxiliaries, and refinement planning for less predictable movements.
Keywords: clear aligners; Invisalign; Spark; Angel Aligner; HeySmile; tooth movement; predictability; secondary data; orthodontics; digital treatment planning.

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1. Introduction

Clear aligner therapy has become an increasingly accepted orthodontic treatment modality because of its esthetic appearance, removability, digital planning workflow, and improved patient comfort compared with conventional fixed appliances. However, one of the major clinical concerns in aligner therapy is the difference between the tooth movement planned in digital software and the movement actually achieved clinically.

The predictability of clear aligner therapy is influenced by several factors, including aligner material, aligner thickness, trimline design, attachment configuration, staging protocol, interproximal reduction, tooth morphology, root anatomy, periodontal support, malocclusion

complexity, and patient compliance. Therefore, a digitally planned final setup should be interpreted as a biomechanical prediction rather than a guaranteed clinical outcome.

Early prospective evidence by Kravitz et al. showed that the mean accuracy of tooth movement with Invisalign was **41%**. In that study, lingual constriction was the most accurate movement at **47.1%**, while extrusion was the least accurate movement at **29.6%**. The extrusion of maxillary central incisors showed particularly low accuracy at **18.3%**, and mandibular central incisor extrusion showed **24.5%** accuracy [1].

A later prospective follow-up study by Haouili et al. reported that Invisalign accuracy had improved, with an overall mean accuracy of approximately **50%**. However, the study still found that rotations and mandibular incisor intrusion remained relatively less predictable movements [2].

More recently, multi-brand evidence has become available. Suárez et al. compared Angel Aligners, Invisalign, Spark, and HeySmile in adult patients requiring dentoalveolar expansion and reported overall predictability values ranging from **57.153%** to **60.002%** across brands [7].

Based on these findings, the present study aimed to synthesize published secondary data on the predictability of tooth movement using different clear aligner brands.

Aim

The aim of this study was to evaluate and compare the predictability of orthodontic tooth movement using different clear aligner brands based on published secondary clinical data.

Research Question

How predictable is tooth movement with different clear aligner brands, and which tooth movements show the highest and lowest predictability according to published clinical evidence?

Null Hypothesis

There is no clinically relevant difference in tooth movement predictability among different clear aligner brands or movement types.

2. Materials and Methods

Study Design

This study was designed as a **secondary-data-based comparative clinical evidence study**. It was not a primary prospective clinical trial. Published clinical studies and systematic reviews were used as the data source.

The study followed a structured evidence-synthesis approach. Articles were screened for data on planned versus achieved tooth movement, movement-specific accuracy, arch-specific predictability, tooth-group predictability, and aligner brand comparison.

Literature Identification and Data Selection

Published studies were selected if they reported clinical accuracy, predictability, or achieved/planned tooth movement values for clear aligner therapy. The main multi-brand comparison was taken from the 2025 longitudinal clinical study by Suárez et al., which compared Angel Aligners, Invisalign, Spark, and HeySmile in 100 adult patients [7]. Additional movement-specific values were extracted from studies by Kravitz et al., Haouili et al., Simon et al., Houle et al., Galan-Lopez et al., Harandi et al., Benedetti et al., and Nucera et al. [1–10].

The study selection process is shown in **Figure 1**.

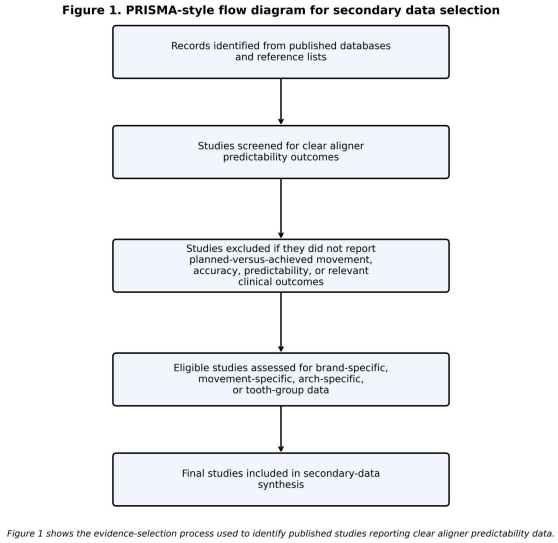


Figure 1. PRISMA-style flow diagram for secondary data selection.

Figure 1 shows the evidence-selection process used to identify published studies reporting clear aligner predictability data.

Inclusion Criteria

Studies were included if they fulfilled the following criteria:

1. Evaluated clear aligner therapy.
2. Reported planned versus achieved tooth movement, accuracy, or predictability.
3. Included clinical patients or systematic review evidence based on clinical data.
4. Reported brand-specific, movement-specific, arch-specific, or tooth-group-specific outcomes.
5. Were published up to 2025.
6. Were available in English.

Exclusion Criteria

Studies were excluded if they:

1. Were purely laboratory or finite element studies without clinical outcome data.
2. Did not report quantitative predictability or accuracy outcomes.
3. Evaluated appliances other than clear aligners.

4. Reported only patient satisfaction without tooth movement data.
5. Had insufficient outcome details for secondary extraction.

Outcome Definition

The primary outcome was **tooth movement predictability**, calculated as:

Predictability = (Achieved_Movement / Planned_Movement) * 100.

EXECUTE.A value of 100% indicates that the planned movement was fully achieved. A value below 100% indicates underexpression of the planned movement.

The conceptual method for planned-versus-achieved assessment is shown in **Figure 2**.

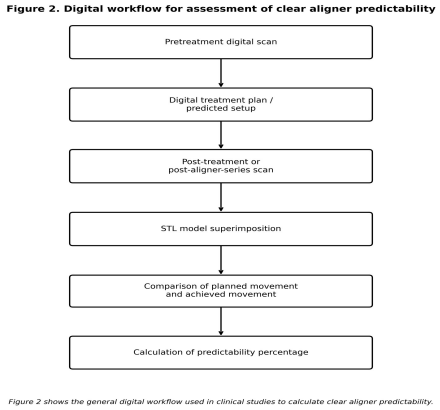


Figure 2. Digital workflow for assessment of clear aligner predictability.

Figure 2 shows the general digital workflow used in clinical studies to calculate clear aligner predictability.

Data Extraction

The following data were extracted:

- Study author and year.
- Study design.
- Aligner system or brand.
- Sample size where reported.
- Overall predictability.
- Brand-specific predictability.
- Arch-specific predictability.
- Tooth-group predictability.
- Movement-specific predictability.
- Main clinical interpretation.

Statistical Approach

Because this study used secondary published data and raw patient-level datasets were not available, no new inferential statistical analysis was performed. Values were reported descriptively as published in the original studies. “NR” indicates data not reported in the accessible source.

3. Results

3.1 Characteristics of Included Studies

The included studies consisted of prospective clinical studies, retrospective clinical studies, longitudinal clinical studies, comparative clinical studies, and systematic reviews. The main brand-level evidence was obtained from Suárez et al. 2025, while most movement-specific evidence was obtained from Invisalign-based studies.

Table 1. Secondary data sources used in the study

Study	Year	Study type	Aligner system	Sample size	Main outcome extracted
Kravitz et al.	2009	Prospective clinical study	Invisalign	37 patients	Overall and movement-specific accuracy
Simon et al.	2014	Clinical study	Invisalign	NR	Torque, premolar derotation, molar distalization
Houle et al.	2017	Clinical study	Invisalign	64 patients	Transverse expansion accuracy
Galan-Lopez et al.	2019	Systematic review	Invisalign	11 studies	Accuracy and efficiency of movements
Haouili et al.	2020	Prospective follow-up study	Invisalign	38 patients	Overall and movement-specific accuracy
Nucera et al.	2022	Systematic review	Multiple aligner systems	NR	Effect of attachments
Harandi et al.	2023	Comparative clinical study	Invisalign and 3M Clarity	NR	Inter-system comparison
Suárez et al.	2025	Longitudinal clinical study	Angel, Invisalign, Spark,	100 patients	Brand-specific expansion

			HeySmile		predictability
Benedetti et al.	2025	Systematic review	Multiple aligner systems	12 studies	Rotational movement accuracy

3.2 Baseline Characteristics of the Main Multi-Brand Study

The main multi-brand study by Suárez et al. included **100 adult patients**, divided equally into four aligner groups: Invisalign, Spark, Angel Aligner, and HeySmile. Each group included 25 patients. The mean age ranged from **32.52 ± 5.33 years** in the Spark group to **35.60 ± 7.02 years** in the Invisalign group [7].

Table 2. Baseline characteristics from the 2025 multi-brand study

Variable	Invisalign	Spark	Angel Aligner	HeySmile
Sample size	25	25	25	25
Mean age, years	35.60 ± 7.02	32.52 ± 5.33	33.24 ± 6.12	32.64 ± 5.11
Male, %	28.0	44.0	44.0	44.0
Female, %	72.0	56.0	56.0	56.0
Main treatment indication	Dentoalveolar expansion	Dentoalveolar expansion	Dentoalveolar expansion	Dentoalveolar expansion
Dentition	Adult permanent dentition	Adult permanent dentition	Adult permanent dentition	Adult permanent dentition

3.3 Brand-Specific Predictability of Dentoalveolar Expansion

Brand-specific analysis showed that Angel Aligner had the highest reported predictability for dentoalveolar expansion at **60.002%**, followed by HeySmile at **59.895%**, Spark at **59.275%**, and Invisalign at **57.153%** [7].

The brand-wise comparison is illustrated in **Figure 3**.

Figure 3. Brand-specific predictability of dentoalveolar expansion.

Angel Aligner |

60.002%
HeySmile |

59.895%
Spark |

59.275%
Invisalign |

57.153%

Figure 3 shows overall expansion predictability by aligner brand, based on the 2025 multi-brand study.

Table 3. Overall predictability by aligner brand for dentoalveolar expansion

Rank	Aligner brand	Overall predictability
1	Angel Aligner	60.002%
2	HeySmile	59.895%
3	Spark	59.275%
4	Invisalign	57.153%

These results suggest modest brand-level differences for dentoalveolar expansion. However, because the data were specific to expansion movements, they should not be generalized to all orthodontic tooth movements.

3.4 Arch-Specific Predictability

Arch-specific findings showed that lower-arch expansion was more predictable than upper-arch expansion. The reported predictability was approximately **61.16%** for the lower arch and **57.01%** for the upper arch [7].

The arch-specific comparison is presented in **Figure 4**.

Figure 4. Arch-specific expansion predictability.

Lower arch |

61.16%
Upper arch |

57.01%

Figure 4 shows that lower-arch expansion was more predictable than upper-arch expansion in the multi-brand dataset.

Table 4. Arch-specific predictability for dentoalveolar expansion

Arch	Predictability
Upper arch	57.01%
Lower arch	61.16%

3.5 Tooth-Group Predictability

Tooth-group analysis showed that second bicuspids had the highest predictability at **63.34%**, followed by first bicuspids at **62.29%**, first molars at **57.12%**, and canines at **53.5%** [7].

The tooth-group pattern is shown in **Figure 5**.

Figure 5. Tooth-group predictability for dentoalveolar expansion.

Second bicuspids / second premolars |

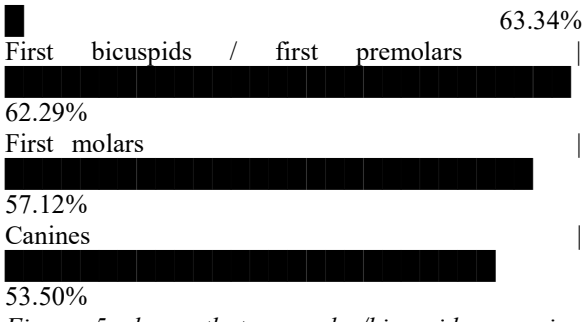



Figure 5 shows that premolar/bicuspid expansion was more predictable than canine expansion.

Table 5. Tooth-group predictability for expansion, regardless of brand

Tooth group	Predictability
Canines	53.5%
First bicuspids / first premolars	62.29%
Second bicuspids / second premolars	63.34%
First molars	57.12%

3.6 Best and Worst Reported Expansion Outcomes

The highest reported predictability in the 2025 multi-brand study was found in the lower arch for second bicuspids using Angel Aligner, with a value of **68.900%**. The lowest reported value was observed for upper canines using Invisalign, with a predictability of **39.290%** [7].

These best and worst values are summarized in **Figure 6**.

Figure 6. Best and worst reported expansion predictability values.

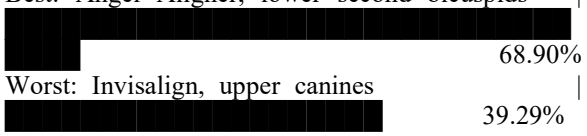


Figure 6 compares the highest and lowest reported tooth-level expansion predictability values from the multi-brand study.

Table 6. Best and worst reported values in the 2025 multi-brand expansion study

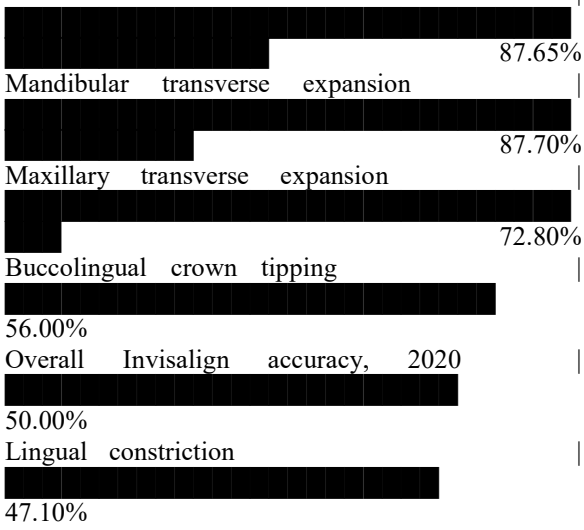
Parameter	Brand / tooth group	Reported value
Highest lower-arch predictability	Angel Aligner, second bicuspids	68.90%
High lower-arch predictability	Angel Aligner, first bicuspids	67.52%
Highest upper-arch predictability	Spark, first bicuspids	65.17%
Second highest upper-arch predictability	HeySmile, first bicuspids	64.90%
Lowest reported predictability	Invisalign, upper canines	39.29%
Greatest achieved lower-arch expansion	HeySmile, second bicuspids	2.64 mm
Greatest achieved upper-arch expansion	HeySmile, second bicuspids	2.57 mm
Smallest achieved upper-arch expansion	Invisalign, canines	1.10 mm
Smallest achieved lower-arch expansion	Invisalign, canines	1.11 mm

3.7 Movement-Specific Predictability from Invisalign Studies

Movement-specific evidence showed substantial variation in aligner predictability. Kravitz et al. reported an overall Invisalign accuracy of **41%**, with extrusion being the least accurate overall movement at **29.6%** [1]. Haouili et al. later reported improved overall accuracy of approximately **50%**, although rotation and mandibular incisor intrusion remained less predictable [2]. Simon et al. reported approximately **42%** accuracy for upper incisor torque, approximately **40%** for premolar derotation, and approximately **87%** for upper molar distalization [3].

The movement-specific pattern is presented in **Figure 7**.

Figure 7. Movement-specific predictability from Invisalign studies.



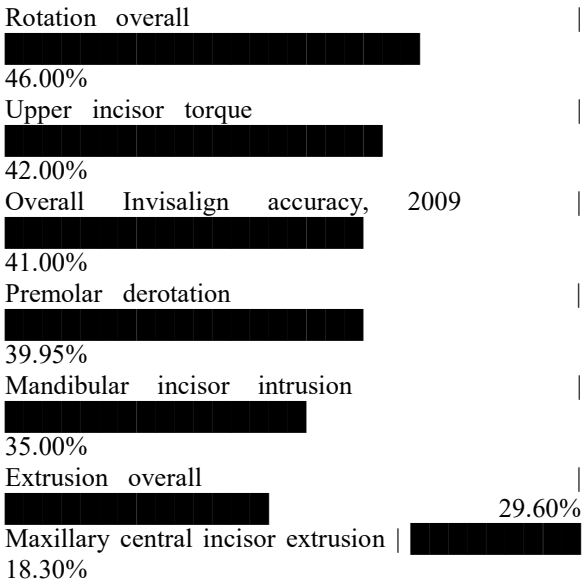


Figure 7 shows that molar distalization and transverse expansion were more predictable than extrusion, derotation, torque, and mandibular incisor intrusion in published Invisalign evidence.

Table 7. Movement-specific predictability from published Invisalign evidence

Movement / outcome	Reported predictability	Source
Overall Invisalign accuracy	41%	Kravitz et al., 2009
Lingual constriction	47.1%	Kravitz et al., 2009
Extrusion overall	29.6%	Kravitz et al., 2009
Maxillary central incisor extrusion	18.3%	Kravitz et al., 2009
Mandibular central incisor extrusion	24.5%	Kravitz et al., 2009
Mandibular canine mesiodistal tipping	26.9%	Kravitz et al., 2009
Overall Invisalign accuracy	50%	Haouili et al., 2020
Buccolingual crown tipping	56%	Haouili et al., 2020
Rotation overall	46%	Haouili et al., 2020
Mesial rotation of mandibular first molar	28%	Haouili et al., 2020
Distal rotation of maxillary canine	37%	Haouili et al., 2020
Mandibular incisor intrusion	35%	Haouili et al., 2020
Upper incisor torque	Approximately 42%	Simon et al., 2014
Premolar derotation	Approximately 40%	Simon et al., 2014
Molar distalization	Approximately 87%	Simon et al., 2014
Maxillary transverse expansion	72.8%	Houle et al., 2017
Mandibular transverse expansion	87.7%	Houle et al., 2017

3.8 Comparative Evidence for Invisalign and 3M Clarity Aligners

Harandi et al. compared Invisalign and 3M Clarity Aligners and reported broadly comparable efficacy in mild-to-moderate malocclusions. However, undercorrection of rotations was reported for selected teeth with 3M Clarity Aligners compared with Invisalign [6].

Table 8. Comparative evidence for Invisalign and 3M Clarity Aligners

Variable	Invisalign	3M Clarity Aligners	Interpretation
Overall treatment efficacy	Comparable	Comparable	Both systems showed similar efficacy in mild-to-moderate cases
Horizontal movements	No major difference reported	No major difference reported	Similar clinical expression
Vertical movements	No major difference reported	No major difference reported	Similar clinical expression
Rotational correction	Better in selected teeth	More undercorrection in selected teeth	Invisalign may have advantage for some rotations
Numeric accuracy values	NR	NR	Complete numeric values were not available in

			accessible abstract-level data

4. Discussion

4.1 Principal Findings

The present secondary-data synthesis showed that clear aligner predictability remains moderate and varies substantially according to aligner brand, arch, tooth group, and movement type. In the main 2025 multi-brand dataset, Angel Aligner showed the highest overall predictability for dentoalveolar expansion, followed by HeySmile, Spark, and Invisalign [7]. However, the numerical differences among brands were relatively small, ranging from **57.153%** to **60.002%**.

These results suggest that brand-related characteristics may influence clinical outcomes, but aligner brand alone cannot explain predictability. Biomechanics, attachments, staging, patient compliance, tooth morphology, and the amount of planned movement likely play equally important roles.

4.2 Interpretation of Brand-Specific Findings

Angel Aligner had the highest reported predictability in the multi-brand expansion study, whereas Invisalign had the lowest predictability in that specific sample. However, Invisalign has the largest body of published evidence, including studies on multiple movement types. Therefore, direct comparison should be interpreted cautiously.

The 2025 multi-brand study focused on **dentoalveolar expansion**, not all orthodontic movements. Therefore, its brand ranking should not be interpreted as proof that one aligner brand is universally superior for torque, intrusion, extrusion, rotation, molar movement, or complete malocclusion correction.

4.3 Arch-Specific Findings

Lower-arch expansion was more predictable than upper-arch expansion in the multi-brand dataset. Houle et al. also reported higher mandibular expansion accuracy than maxillary expansion accuracy with Invisalign, with mean expansion accuracy of **72.8%** for the maxilla and **87.7%** for the mandible [4].

This difference may be related to arch anatomy, tooth inclination, alveolar limitations, and differences between crown tipping and bodily movement. In clear aligner therapy, transverse expansion is often expressed as buccal crown tipping rather than pure bodily expansion. Therefore, clinicians should evaluate root position and periodontal boundaries carefully when planning expansion.

4.4 Tooth-Group Findings

Second bicuspids and first bicuspids showed higher expansion predictability than canines. Canines showed the lowest tooth-group predictability in the 2025 multi-brand dataset. This may be explained by canine root length, crown morphology, aligner grip limitations, and the difficulty of expressing controlled crown and root movement in the canine region.

This finding is clinically important because canines are frequently involved in expansion, rotation correction, and arch coordination. When canine movement is planned, clinicians should consider optimized attachments, slower staging, IPR when appropriate, and overcorrection.

4.5 Movement-Specific Findings

Movement-specific findings showed that extrusion, rotation, torque, and mandibular incisor intrusion remain less predictable. Kravitz et al. reported extrusion as the least accurate movement, while Haouili et al. reported that rotation remained among the least predictable movements despite improvement in overall Invisalign accuracy [1,2].

Simon et al. found that upper molar distalization was more predictable than incisor torque and premolar derotation [3]. This suggests that aligners may perform better for selected movements when adequate anchorage, staging, and aligner adaptation are available. However, derotation of rounded teeth such as premolars remains difficult because of limited aligner grip.

4.6 Role of Attachments

Attachments are important biomechanical auxiliaries in clear aligner therapy. A systematic review by Nucera et al. reported that attachments generally improve the effectiveness of clear aligner treatment, especially for anterior root torque, rotation, mesiodistal movement, and posterior anchorage. However, evidence remains less clear for extrusion and intrusion [9].

Therefore, attachment design should be movement-specific rather than routine. For example, rotation may require optimized or vertical rectangular attachments, while extrusion may require additional aligner grip, auxiliaries, or bonded buttons.

4.7 Clinical Implications

The findings have several clinical implications:

1. Clear aligner predictability should be evaluated by movement type, not only by brand.
2. Digital treatment simulations should not be considered guaranteed clinical outcomes.
3. Expansion planning should distinguish between crown tipping and bodily movement.
4. Canine expansion and premolar derotation require additional biomechanical control.

5. Extrusion, torque, and intrusion should be planned with overcorrection and refinement.
6. Attachments, IPR, auxiliaries, and slower staging may improve outcomes in difficult movements.
7. Patient compliance remains essential for achieving planned movement.

4.8 Strengths of the Study

The strength of this study is that it synthesizes brand-specific, arch-specific, tooth-group-specific, and movement-specific data from published clinical evidence up to 2025. It also integrates older foundational Invisalign studies with newer multi-brand evidence.

4.9 Limitations

This study has several limitations. First, it used secondary published data rather than original patient-level data. Second, raw datasets were unavailable, so new inferential statistical analysis could not be performed. Third, the main multi-brand evidence focused on dentoalveolar expansion and may not apply to all orthodontic movements. Fourth, different studies used different software, measurement protocols, staging designs, attachment strategies, aligner materials, and compliance-monitoring methods. Fifth, Invisalign has more published evidence than newer systems, making direct brand comparison uneven.

5. Conclusion

Based on secondary clinical evidence up to 2025, clear aligner predictability remains moderate and varies according to aligner brand, arch, tooth group, and movement type. In the available multi-brand expansion evidence, Angel Aligner showed the highest overall predictability at **60.002%**, followed by HeySmile **59.895%**, Spark **59.275%**, and Invisalign **57.153%**. Lower-arch expansion was more predictable than upper-arch expansion. Premolars/bicuspids showed higher predictability than canines.

Across movement types, molar distalization and selected transverse expansion movements showed relatively higher predictability, while extrusion, rotation, torque, premolar derotation, and mandibular incisor intrusion remained less predictable. Clinicians should use overcorrection, optimized attachments, movement-specific staging, auxiliaries, and planned refinements for difficult movements.

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