Clear Aligner Treatment in China: a Cross-sectional Survey of Clinical Practice among Dental Practitioners

Le Bei WANG[1], Ting DONG, Nian Song YE[2], Lun Guo XIA[1], Bing FANG[1]

Objective: *To investigate the clinical application of clear aligner therapy (CAT) among Chinese dental practitioners, focusing on case selection, treatment strategies, aligner change intervals and recall schedules, and compare CAT with fixed appliances in clinical decision making.*
Methods: *A nationwide online cross-sectional survey of licensed dental practitioners in China was conducted from June to November 2024. A structured questionnaire collected information on demographics, CAT case selection, treatment strategies and clinical management practices. Descriptive statistics were conducted.*
Results: *CAT was the choice of 87.74% of respondents (n = 1,066), mainly driven by patient demand and expected compliance (88.84%). The high cost was identified as the main hindrance. CAT was most commonly prescribed to adult patients, especially those aged 26 to 30 years. For dental crowding, clinicians more often preferred arch expansion or molar distalisation over interproximal enamel reduction or extraction. In extraction cases, four-premolar extraction was the most common pattern. Rotation and root control were perceived to be the most difficult tooth movements. Most respondents reported aligner changes every 7 to 14 days (n = 608 [57.04%], every 7 to 10 days; n = 389 [36.49%], every 10 to 14 days). Recall visits were typically every 6 to 12 weeks (n = 389 [36.49%], every 6 to 8 weeks; n = 355 [33.30%], every 8 to 12 weeks).*
Conclusion: *CAT has been widely adopted by Chinese dental practitioners, especially for the treatment of adult patients with mild to moderate malocclusion. Standard clinical protocols most often require aligner changes at 7- to 10-day intervals and patient recall visits at 6 to 8 weeks.*
Keywords: *clear aligner treatment, cross-sectional survey, orthodontic practice, treatment strategy*
Chin J Dent Res 2026;29(3):255–266; doi: 10.3290/j.cjdr.b7093219

Clear aligner therapy (CAT) has quickly become a prominent treatment in Chinese orthodontic practice, mainly because of the benefits it offers in terms of aesthetics, patient comfort and ease of oral hygiene maintenance.[1] Alongside the continued development of digital workflows and materials science, orthodontic treatment has gradually moved away from traditional fixed appliances towards aligner-based treatment, allowing for more precise, efficient and aesthetically acceptable treatment.[2] Despite these benefits, CAT is a topic of debate, at least in part because it is largely a commercial-driven industry. Key clinical parameters, such as aligner change intervals and total treatment duration, have not been fully standardised and reported treatment efficiency and predictability vary considerably depending on tooth movements and case complexity.[3-6] Furthermore, treatment outcomes are highly dependent on patient compliance. The optimal use of early interventions and remote monitoring technologies to improve adherence and improve clinical outcomes therefore needs further investigation.[7,8] Manufacturing costs may also limit the use of CAT for some primary care settings and less-resourced areas. Although CAT has grown rapidly in China, large-scale real-world evidence on clinical usage

1 Department of Orthodontics, Shanghai Ninth People's Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, P.R. China
2 Shanghai Huaguang Dental Clinic, Shanghai, P.R. China

Corresponding authors: Prof Bing FANG and Prof Lun Guo XIA, Department of Orthodontics, Shanghai Ninth People's Hospital, Shanghai Jiaotong University School of Medicine, 639# Zhizaoju Road, HuangPu District, Shanghai 200011, P.R. China. Tel: 86-21-23271699. Email: fangbing@sjtu.edu.cn; xialunguo@hotmail.com.
Dr Nian Song YE, Shanghai Huaguang Dental Clinic, 6C, No. 201, Ln 3215, Hongmei Rd, Shanghai 201103, P.R. China. Email: yns119@126.com.

patterns, case selection and aligner management protocols is still limited.

Accordingly, the present authors performed a nationwide questionnaire-based survey to investigate the use of CAT in dental practice among dental practitioners in China. The survey covered important aspects of administration of CAT including case selection, treatment strategies, especially approaches to crowding management and extraction planning, perceived difficulty of the various tooth movements, aligner change intervals and patient recall schedules. The goals were to describe the patterns of CAT practice in the field, the factors that affect clinical decision making and how clinicians position CAT in relation to fixed orthodontic appliances. This study was descriptive and exploratory in nature and no prespecified hypotheses were tested.

Materials and methods

Study design and ethics

This study was a nationwide, cross-sectional online survey that took place between June and November 2024. Ethical approval was granted by the Ethics Committee of Shanghai Ninth People's Hospital, Shanghai Jiaotong University School of Medicine (approval no. SH9H-2024-T195-1). This report follows the Strengthening the Reporting of Observational Studies in epidemiology (STROBE) statement.[9] The completed STROBE checklist is included as a supplementary file (provided on request).[10]

Setting

The questionnaire was delivered through Wenjuanxing (WJX; Changsha, Ranxing Information Technology, China), a safe and professional online survey platform that is widely used for large-scale research in China. Participation was voluntary and anonymous and access to the collected data was restricted to the research team.

Participants and recruitment

Participants were recruited via nationwide, regionally diverse online group chats for dental practitioners via a QR code with direct access to the questionnaire.

Eligibility and data quality control

Eligible participants were licensed dental practitioners in China, such as orthodontic specialists, general dental practitioners and assistant dental practitioners, who were actively providing orthodontic care. Eligibility screening and completion checks were incorporated into the online questionnaire. The respondents who did not meet the inclusion criteria and/or who did not complete the required items were prevented from submitting the questionnaire and thus excluded from the final data set. To reduce duplicate entries, the survey platform only allowed submissions from a single response per device and IP address.

Questionnaire development and content

To guarantee scientific rigour and clinical relevance, the Department of Orthodontics of Shanghai Ninth People's hospital performed a literature review and cited previous surveys, including those conducted by Abu Arqub et al,[11] who examined CAT protocols and preferences of members of the American and Canadian associations of orthodontists, and Meade et al,[12] who examined CAT practice patterns for members of the British Orthodontic Society. The content validity of the questionnaire was assessed by a panel of five senior orthodontists. A pilot test of 20 clinicians evaluated clarity and usability and minor revisions were made before national distribution. All items were closed-ended to standardise responses, and no personally identifiable information was collected. The average time taken to complete was around 15 minutes. The final questionnaire consisted of 38 closed-ended questions divided into three sections: respondent demographics and clinical experience with CAT; patient selection, demand and satisfaction and clinician's confidence in treating various types of malocclusion; and treatment strategies and adjustment measures (Appendix 1, provided on request).

Variables

The primary outcome was the clinical use of CAT, which was defined as the self-reported provision of CAT in routine orthodontic practice. Secondary outcomes were CAT-related treatment strategies, aligner change intervals, recall schedules, treatment planning behaviours and perceived difficulty of various tooth movements. Predictor variables included demographic variables (age, sex), number of years of orthodontic experience, type of practice setting and geographic region. Categorical variables (e.g. age range and years of experience) were grouped according to cut-offs used in the literature on the orthodontic workforce to enable international comparisons.

Bias

Selection bias was addressed by national distribution of the questionnaire in a variety of practice settings. Information bias was minimised by the use of standardised closed-ended questions and the exclusion of free-text responses. Possible duplicate responses were limited by restrictions on the platform; however, non-response bias cannot be ruled out completely because participation was voluntary and the open sampling frame made it impossible to calculate response rates.

Sample size

The sample size of the study was based on the number of valid questionnaires collected during the study period. A total of 1,215 valid responses were included in the analysis. Of these, 1,066 respondents (87.74%) reported that they provided CAT and completed the CAT-specific items whereas 149 respondents (12.26%) did not provide CAT and completed only the non-CAT sections.

Statistical methods

All the questionnaire items were analysed at the level of respondents. Categorical and ordinal variables were summarised as frequencies and percentages. For Likert-type items and rating scales, distributions of responses across categories were presented and mean scores were calculated to give an overall indication of perceived difficulty or agreement. Age and years of experience were obtained as pre-specified categories. Likert-type items were analysed as ordinal variables and were summarised with frequencies and percentages, and mean scores were reported in addition to providing a descriptive summary.

The analyses were essentially descriptive and exploratory. No formal hypothesis testing or multivariable modelling was conducted because the goal was to describe real-world patterns of clear aligner use, not to test prespecified hypotheses. Descriptive statistics such as frequencies and percentages and mean scores were obtained using the built-in statistical functions of the Wenjuanxing online survey platform. Participants were recruited through convenience sampling by online professional group chats; no sampling weights were used, and the analyses did not consider a complex sampling design.

Missing data

As required items completion was enforced by the survey settings prior to submission, there were no missing data for the key variables reported in this study.

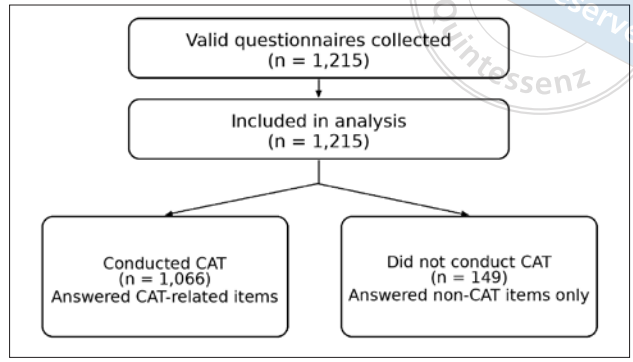

Fig 1 Participant flow diagram. Ineligible respondents and incomplete questionnaires were prevented from final submission by survey settings; therefore, no post-submission exclusions were applied.

Results

Respondents and geographic distribution

By November 2024, a total of 1,215 valid responses had been collected (Fig 1). Response rates were higher in the east than in the west and higher in developed cities than in less developed cities.

Demographic and practice characteristics

The majority of respondents were women and aged between 30 and 50 years. General dental practitioners and orthodontic specialists were roughly equal in number, with a small percentage of assistant dental practitioners. Private clinics were the most common practice setting, followed by public general hospitals and stomatological hospitals. Most reported 3 to 10 years of experience with CAT (Table 1).

Utilisation of CAT and drivers/barriers

CAT was used by 87.74% of respondents (n = 1,066). Patient demand and expected treatment compliance (88.84%, n = 947) were the most influential factors in the decision to offer CAT, whereas the high treatment cost and limited equipment were the primary reasons for not doing so. Additional reasons included poor patient compliance, duration of treatment and concerns about treatment effectiveness (Table 2). An optional free-text field was offered to those respondents choosing "other reasons" (40.94%, n = 61); common responses included inadequate orthodontic training, lack of clinical exposure or lack of opportunity. Among the clinicians who offered CAT, almost half treated 10 or fewer aligner

Table 1 Demographic and practice characteristics

Question	Item	n (%)
What is your age (years)?	20–30	123 (10.12)
	30–40	585 (48.15)
	40–50	350 (28.81)
	50–60	143 (11.77)
	> 60	14 (1.15)
What is your sex?	Male	428 (35.23)
	Female	787 (64.77)
What is the type of your primary practice setting?	Public general hospital	414 (34.07)
	Stomatological (dental) hospital	248 (20.41)
	Private dental clinic	553 (45.51)
What is your professional category?	General dental practitioner	590 (48.56)
	Orthodontic specialist	591 (48.64)
	Assistant dental practitioner	34 (2.80)
How long have you been providing CAT (years)?	< 1	73 (6.85)
	1–2	180 (16.89)
	3–5	336 (31.52)
	6–10	348 (32.65)
	11–15	96 (9.01)
	> 15	33 (3.10)

Table 2 Reasons for not choosing CAT.

Reason	n (%)
Treatment is too expensive	56 (37.58)
Treatment duration is long	19 (12.75)
Treatment outcomes are not ideal	18 (12.08)
Poor patient compliance	30 (20.13)
Insufficient materials/equipment	37 (24.83)
Other reasons	61 (40.94)

cases annually (Fig 2a), and about two-thirds said aligners made up less than 20% of their total orthodontic caseload (Fig 2b). Orthodontic specialists said they treated more CAT cases per year than general dental practitioners and assistant dental practitioners.

Patient age groups and demand for CAT

CAT was used in all age groups, but was most often prescribed for adult patients, especially those aged 26 to 30 years. Use in primary dentition was rare and indications in mixed dentition were selective. Patient demand was greater for adolescents with permanent dentition and adults than for younger children (Table 3).

Digital treatment planning

Most clinicians (79.55%, n = 848) usually revised the digital treatment plan two to three times, with 63.51% (n = 677) taking a mean of 5 to 20 minutes to perform revisions. Over half of the respondents (52.43%, n = 559) reported that they modified the position and attachments of target teeth occasionally or sometimes manually.

Treatment strategies

Temporary anchorage devices (TADs) were often used as auxiliaries when they were indicated, and segmental archwires were used occasionally or sometimes by most clinicians. Recall visits were usually scheduled every 6 to 12 weeks and almost all respondents recommended aligner changes every 7 to 14 days, most commonly at 7- to 10-day intervals (Fig 3).

Strategies for resolving crowding

For CAT cases with crowding, clinicians mostly used arch expansion and molar distalisation, whereas interproximal reduction (IPR) and extractions were less commonly used (Fig 4).

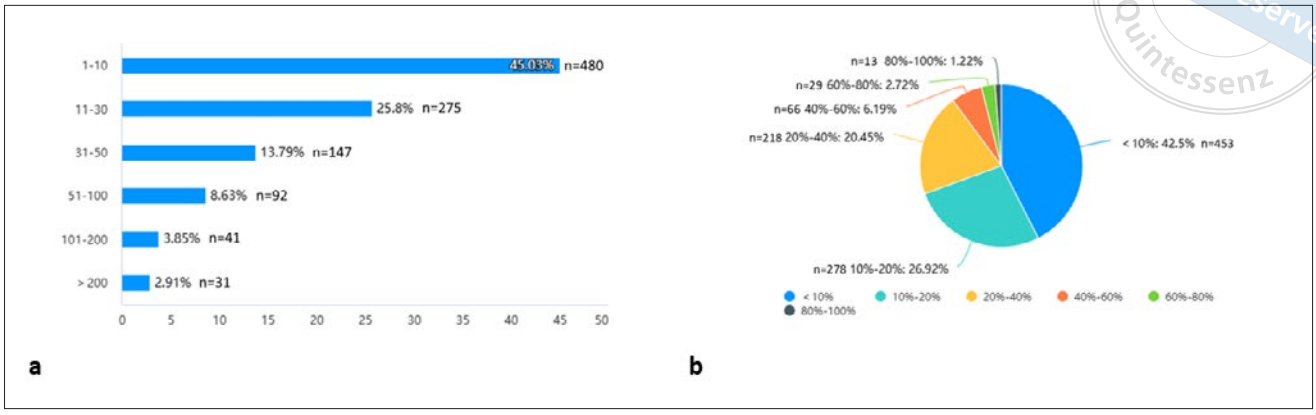

Fig 2a and b Number of CAT cases annually per clinician **(a)**; proportion of CAT cases among total orthodontic cases **(b)**.

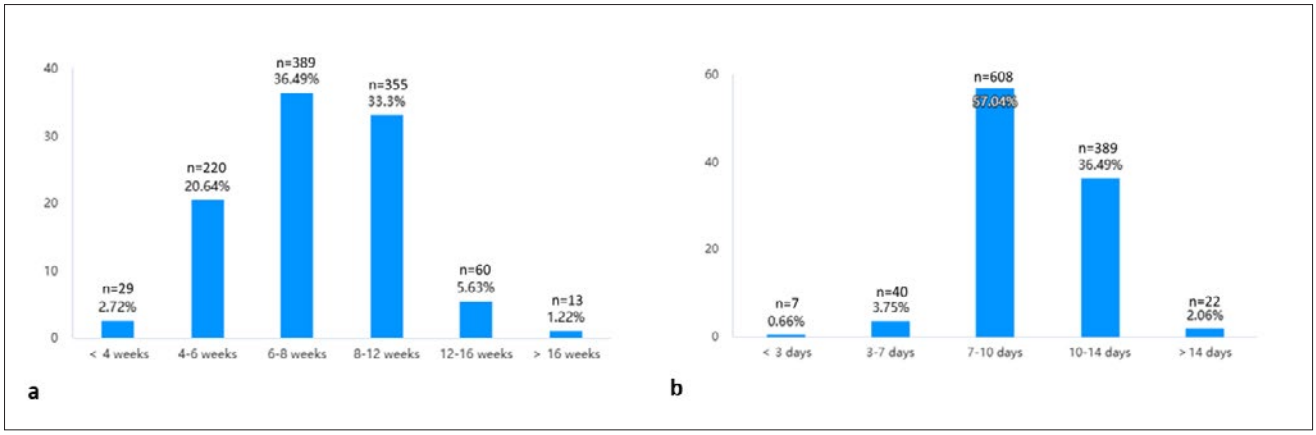

Fig 3a and b Recall frequency for clear aligner patients **(a)**; change intervals in CAT **(b)**.

Table 3 Demand for CAT across age groups.

Age group		Never, n (%)	Occasionally, n (%)	Sometimes, n (%)	Often, n (%)	Always, n (%)
Primary dentition		813 (76.27)	164 (15.38)	66 (6.19)	20 (1.88)	3 (0.28)
Mixed dentition		258 (24.2)	446 (41.84)	227 (21.29)	123 (11.54)	12 (1.13)
Adolescents (permanent dentition)		43 (4.03)	230 (21.58)	521 (48.87)	244 (22.89)	28 (2.63)
Adults		23 (2.16)	99 (9.29)	417 (39.12)	454 (42.59)	73 (6.85)
Age distribution among adult CAT patients, n (%)	18–25 y	400 (37.52)				
	26–30 y	482 (45.22)				
	31–35 y	141 (13.23)				
	36–40 y	35 (3.28)				
	41–50 y	6 (0.56)				
	51–60 y	2 (0.19)				

Table 4 Frequency of extraction patterns used with CAT.

Extraction pattern	Never, n (%)	Occasionally, n (%)	Sometimes, n (%)	Often, n (%)	Always, n (%)
Four premolars	52 (5.56)	165 (17.65)	268 (28.66)	411 (43.96)	39 (4.17)
Two premolars	168 (17.97)	351 (37.54)	346 (37.01)	68 (7.27)	2 (0.21)
One premolar	475 (50.80)	329 (35.19)	114 (12.19)	15 (1.60)	2 (0.21)
One mandibular incisor	148 (15.83)	400 (42.78)	305 (32.62)	78 (8.34)	4 (0.43)
Second molar	462 (49.41)	302 (32.30)	140 (14.97)	29 (3.10)	2 (0.21)

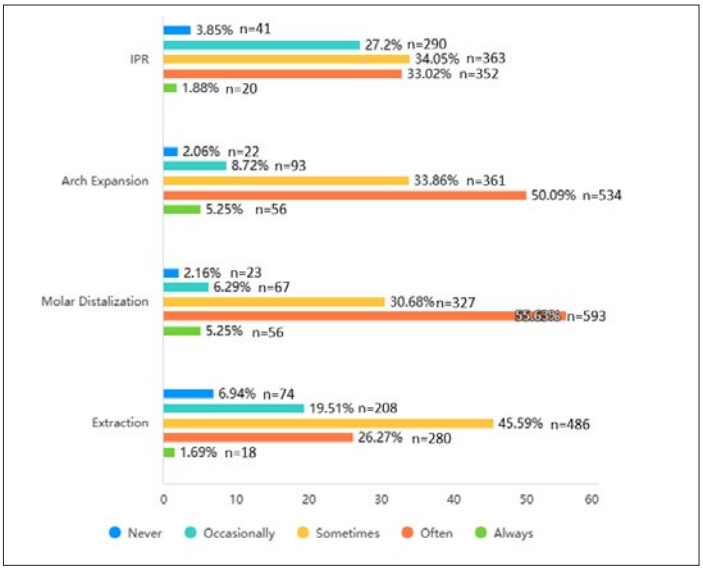

Fig 4 Preferred strategies to resolve crowding in CAT among Chinese dental practitioners.

Table 5 Retention methods after CAT.

Retention method	Never, n (%)	Occasionally, n (%)	Sometimes, n (%)	Often, n (%)	Always, n (%)
Clear thermoplastic retainer	34 (3.19)	43 (4.03)	89 (8.35)	554 (51.97)	346 (32.46)
Hawley retainer	183 (17.17)	358 (33.58)	299 (28.05)	175 (16.42)	51 (4.78)
Lingual bonded retainer	288 (27.02)	369 (34.62)	261 (24.48)	119 (11.16)	29 (2.72)
Combination of ≥ 2 retainers	279 (26.17)	295 (27.67)	255 (23.92)	172 (16.14)	65 (6.10)
Using the last set of aligners as retainers	418 (39.21)	289 (27.11)	205 (19.23)	112 (10.51)	42 (3.94)

Use of CAT in extraction cases and extraction patterns

Most clinicians reported performing CAT for extraction cases only occasionally or sometimes, and private clinics appeared more cautious than public institutions. When CAT was used for extraction treatment, extraction of four premolars was the most frequent pattern, followed by extraction of two premolars, and other patterns were chosen less often (Table 4).

Retention after CAT

Clear thermoplastic retainers were the most popular retention modality selected after CAT, while the use of the last set of aligners as retainers was the least popular retention approach (Table 5).

Perceived difficulty of tooth movements and malocclusions

Table 6 summarises clinicians' perceptions of the difficulty of achieving different tooth movements using CAT and their confidence dealing with different malocclusion categories. Intrusion was rated as the easiest movement to achieve, and extrusion and bodily movement were rated as moderately difficult. Rotation and root control were found to be the most difficult. In general, cases involving mild to moderate crowding, spacing or single mandibular incisor extractions were perceived as easy or moderately difficult. Conditions such as midline discrepancies greater than 2 mm, Class II molar relationships requiring distalisation, dental anterior crossbite and missing tooth cases were rated as generally moderately difficult. Complex cases, such as severe crowding, deep horizontal overlap of more than 8 mm, two-premolar extractions, deep vertical overlap, anterior open bite, posterior crossbite, posterior scissor bite and periodontally compromised malocclusion, were most frequently judged to be of moderate to high difficulty. The greatest difficulty ratings were given to impacted canines or incisors, severe skeletal Class II/III cases demanding surgical intervention, facial asymmetry and malocclusion associated with temporomandibular disorders.

Treatment duration, effectiveness and satisfaction

Approximately half of the respondents felt that performing CAT to treat patients takes longer than other modalities, with the rest neutral or disagreeing. When comparing the effectiveness of treatment, most clinicians

Table 6 Perceived difficulty of achieving different tooth movements with CAT and confidence in treating various malocclusion cases.

Question	Item	Very easy, n (%)	Easy, n (%)	Moderate, n (%)	Difficult, n (%)	Very difficult, n (%)
How do you rate the difficulty of performing the following tooth movements with CAT?	Tipping	265 (24.86)	547 (51.31)	192 (18.01)	56 (5.25)	6 (0.56)
	Intrusion	70 (6.57)	439 (41.18)	413 (38.74)	124 (11.63)	20 (1.88)
	Extrusion	20 (1.88)	139 (13.04)	391 (36.68)	420 (39.40)	96 (9.01)
	Rotation	14 (1.31)	127 (11.91)	343 (32.18)	457 (42.87)	125 (11.73)
	Root control	20 (1.88)	160 (15.01)	459 (43.06)	355 (33.30)	72 (6.75)
	Bodily movement	20 (1.88)	122 (11.44)	445 (41.74)	356 (33.40)	123 (11.54)
How confident are you in treating the following cases with clear aligners?	Mild crowding	546 (51.22)	422 (39.59)	90 (8.44)	7 (0.66)	1 (0.09)
	Moderate crowding	109 (10.23)	428 (40.15)	461 (43.25)	62 (5.82)	6 (0.56)
	Severe crowding	70 (6.57)	217 (20.36)	393 (36.87)	318 (29.83)	68 (6.38)
	Spacing	219 (20.54)	463 (43.43)	327 (30.68)	45 (4.22)	12 (1.13)
	Midline deviation > 2 mm	60 (5.63)	285 (26.74)	529 (49.62)	181 (16.98)	11 (1.03)
	Deep vertical overlap > 8 mm	9 (0.84)	55 (5.16)	297 (27.86)	556 (52.16)	149 (13.98)
	Four-premolar extraction	13 (1.22)	66 (6.19)	475 (44.56)	426 (39.96)	86 (8.07)
	Two-premolar extraction	12 (1.13)	104 (9.76)	611 (57.32)	301 (28.24)	38 (3.56)
	Mandibular incisor extraction	70 (6.57)	469 (44.00)	463 (43.43)	57 (5.35)	7 (0.66)
	Class II molar distalisation	37 (3.47)	274 (25.70)	599 (56.19)	137 (12.85)	19 (1.78)
	Dental crossbite	54 (5.07)	378 (35.46)	487 (45.68)	124 (11.63)	23 (2.16)
	Deep bite	18 (1.69)	124 (11.63)	496 (46.53)	385 (36.12)	43 (4.03)
	Anterior open bite	13 (1.22)	139 (13.04)	543 (50.94)	312 (29.27)	59 (5.53)
	Posterior crossbite	10 (0.94)	86 (8.07)	472 (44.28)	442 (41.46)	56 (5.25)
	Posterior scissor bite	10 (0.94)	107 (10.04)	502 (47.09)	393 (36.87)	54 (5.07)
	Missing teeth	18 (1.69)	146 (13.70)	638 (59.85)	234 (21.95)	30 (2.81)
	Malocclusion with periodontal disease	16 (1.50)	66 (6.19)	459 (43.06)	424 (39.77)	101 (9.47)
	Impacted canines/incisors	10 (0.94)	31 (2.91)	297 (27.86)	544 (51.03)	184 (17.26)
	Severe skeletal Class II/III requiring surgery	12 (1.13)	54 (5.07)	233 (21.86)	347 (32.55)	420 (39.40)
	Facial asymmetry	8 (0.75)	19 (1.78)	202 (18.95)	467 (43.81)	370 (34.71)
	Malocclusion with temporomandibular disorders	9 (0.84)	22 (2.06)	213 (19.98)	433 (40.62)	389 (36.49)

indicated a neutral position, with a minority perceiving CAT to produce superior outcomes compared to fixed appliances. Despite this, overall patient and clinician satisfaction with CAT outcomes was high, with only a small proportion reporting dissatisfaction (Table 7).

Cost perceptions and in-office aligner fabrication

Regarding processing costs, 57.88% of respondents (n = 617) thought that domestic aligner brands were overpriced, whereas 40.62% (n = 433) thought that they were reasonably priced. Imported brands were seen as overpriced by most clinicians (84.62%, n = 902) with only 14.45% (n = 154) considering their cost reasonable. Most respondents (87.43%, n = 932) had never tried chairside clear aligner fabrication, whereas 12.57% (n = 134) had.

Discussion

This nationwide survey provides a comprehensive overview of the implementation of CAT in routine clinical practice in China. Most practitioners have incorporated CAT into their workflows, predominantly for adult patients with mild to moderate malocclusion, favouring non-invasive strategies such as arch expansion and molar distalisation while adopting a cautious approach to extraction and complex skeletal cases. These findings support CAT as a mainstream option for selected indications, whereas fixed appliances or hybrid approaches remain preferable for cases requiring complex biomechanics or extensive extractions.

The present findings also highlight areas requiring further investigation, including the optimisation of clinical protocols, the predictability of aligner biomechanics in extraction-based and severe malocclusions and the cost-effectiveness of CAT compared with fixed appliances.

National uptake of CAT compared with international data

In this survey, 87.74% of respondents said they use CAT in clinical practice, which shows that aligners have become a regular treatment option among Chinese

Table 7 Treatment duration, outcomes and satisfaction with CAT.

Question	Item	n (%)
Compared with other orthodontic techniques, do you think CAT takes too long?	Strongly agree	113 (10.60)
	Agree	423 (39.68)
	Neither agree nor disagree	411 (38.56)
	Disagree	109 (10.23)
	Strongly disagree	10 (0.94)
Compared with other orthodontic techniques, do you think CAT has better outcomes?	Strongly agree	27 (2.53)
	Agree	143 (13.41)
	Neither agree nor disagree	678 (63.60)
	Disagree	211 (19.79)
	Strongly disagree	7 (0.66)
How satisfied are your patients with the treatment outcomes of CAT?	Very dissatisfied	9 (0.84)
	Dissatisfied	7 (0.66)
	Neutral	333 (31.24)
	Satisfied	668 (62.66)
	Very satisfied	49 (4.60)
How satisfied are you with the treatment outcomes of CAT?	Very dissatisfied	7 (0.66)
	Dissatisfied	16 (1.50)
	Neutral	448 (42.03)
	Satisfied	561 (52.63)
	Very satisfied	34 (3.19)

dental practitioners. This level of adoption is broadly similar but not identical to rates of utilisation reported in recent surveys of orthodontists and general dental practitioners in North America, Europe and Oceania, where aligner use typically ranged from approximately 65% to over 90% of respondents.[11-17]

Approaches to resolving crowding

Aligners show reasonable predictability for crowding relief, although there is a possibility of deviations from the virtual setup in post-treatment arch forms.[18] In the present survey, the most common choice among Chinese clinicians was arch expansion and molar distalisation, non-invasive strategies that do not involve enamel destruction and are generally well accepted by patients, especially in cases of mild to moderate crowding. IPR and extractions were less common (Fig 4) and there was a cautious approach to irreversible procedures.

Non-invasive strategies: arch expansion and molar distalisation

CAT is suitable for patients with limited arch width (≤ 6 mm); however, the skeletal expansion effect is usually small and is often accompanied by buccal tipping and reduced predictability.[18-20] Refinement stages can improve treatment accuracy.[21]

The factors that determine the efficiency of molar distalisation include anchorage design, concomitant anterior retraction and the presence of deep horizontal or vertical overlap.[1,22] The efficiency is reduced when distalisation is combined with anterior retraction or when employed in cases with deep bite or horizontal overlap.[22,23] The use of TADs and/or IPR as auxiliaries may increase control and treatment stability.[1,22]

Conservative use of IPR

Compared to Chinese clinicians, practitioners in Australia, New Zealand, Canada and France are more likely to use IPR to relieve crowding.[13,15,17,24]

IPR creates space without loss of dentition; however, its accuracy is operator dependent and less predictable.[18,25] Besides, IPR may cause potential risks including thermal or pulpal damage, caries, soft tissue trauma and dentine hypersensitivity, which may partly explain its more conservative use in China.[26,27] Consequently, IPR should be performed only in cases where it is clearly indicated and supported by careful digital planning and attachment design to increase precision and reduce complications.

Extraction patterns in CAT

Clinical use of CAT in extraction cases

Management of extraction cases is one of the most difficult and controversial areas of CAT. Nonetheless, extraction is still beneficial in moderate to severe cases

of crowding.[28-30] The present study found that Chinese dental practitioners take a relatively proactive but cautious attitude to extractions with CAT, with their preferred extraction patterns being different to those reported by their international peers.

In the present survey, 69.42% of practitioners (n = 740) said that CAT accounted for less than 20% of their orthodontic cases. Similar caution regarding aligner use in premolar extraction cases has been reported in North America and Canada.[11,24]

Factors influencing extraction decisions in China

The lower rate of extraction cases treated with CAT in China may reflect both patient and case characteristics as well as clinician preferences. The domestic aligner market is largely adult-orientated, and clinicians may be more inclined to use non-extraction approaches to crowding in adults.[31] Epidemiologic data also show a high prevalence of crowding in Chinese and East Asian populations,[32,33] with severe cases often resulting in premolar extraction and massive tooth movements using conventional mechanics. Moreover, based on current knowledge, CAT is less predictable for complex 3D movements, especially in premolar extraction cases.[34]

Consistently, maxillomandibular protrusion cases that require extraction and anterior retraction and premolar extraction cases with more than 2 mm posterior protraction were classified as low-predictability indications in the 2021 guideline published by the Chinese Stomatological Association and were advised not to be managed by inexperienced clinicians.[35] The guideline also describes molar distalisation as a common strategy in adult cases of crowding and borderline extraction cases.[35] These recommendations likely push Chinese clinicians to focus on arch expansion, distalisation and IPR if possible, and they should also be careful regarding extensive extraction protocols with aligners.

International extraction patterns and biomechanical considerations

In the present survey, 48.13% of Chinese clinicians (n = 450) reported that they frequently or always choose four-premolar extraction in CAT, the most frequently used extraction pattern (Table 4), and rarely mandibular incisor extraction. These results indicate that many Chinese clinicians still adopt conventional extraction principles in aligner treatment, using four-premolar extraction to achieve symmetrical space and promote arch coordination.

In contrast, surveys conducted in France, Canada, New Zealand and Australia report low frequency of use of CAT for premolar extraction cases.[11,15-17] For mandibular incisor extraction, however, CAT appears to be more selectively considered in the United States,[11] Australia[15] and France[36] as a localised treatment strategy. These results indicate that international practitioners are more inclined to consider localised or asymmetrical extraction strategies for CAT and to be wary of extensive premolar extractions. The 2025 international expert consensus similarly emphasises individualised extraction selection based on space requirements and malocclusion characteristics.[1] Biomechanical evidence helps to explain this cautious approach. Extraction space closure with aligners may generate retraction forces and lingual moments on the anterior teeth, leading to lingual tipping, extrusion and anchorage loss, with documented discrepancies between predicted and achieved tooth movements.[37-40] Discrepancies between predicted and achieved movements have been reported, particularly for molars, central incisors and canines.[38] In four first-premolar extraction cases, these effects are most pronounced, whereas after second premolar extraction, adjacent molars may tip mesially, with maxillary posterior teeth tending to exhibit greater mesial tipping than mandibular teeth.[37,40] In mandibular incisor extraction cases, considerable retractive forces are placed on anterior teeth while posterior teeth must provide mesial anchorage, and mesiodistal control discrepancies have been documented, with central incisors often more difficult to control than canines.[37,41]

Overall, Chinese clinicians are more likely to use a standard four-premolar extraction pattern in CAT, whereas clinicians in other countries are more likely to employ localised or asymmetrical extraction strategies. These differences underscore the need for extraction planning in aligner therapy to be guided by case complexity and biomechanical feasibility rather than direct extrapolation from fixed appliance protocols.

Difficulty of tooth movements and case selection

In the present survey, intrusion was considered the tooth movement achieved most easily using CAT followed by extrusion and bodily movement, whereas rotation and root control were the most difficult. International evidence is consistent and there is high predictability for tipping movements (> 80%) and low success rates for root control (< 30%). Other difficult movements are active extrusion of maxillary incisors, rotation of cylindrical teeth and posterior distalisation.[42]

Globally, clinicians usually restrict the use of CAT to mild to moderate malocclusion and report low confidence in treating extraction cases, severe crowding and deep bite using aligners alone.[13,24] Orthodontic specialists are more inclined to treat complex cases than general dental practitioners.[14] In the present survey, perceived difficulty increased with case complexity, with mild malocclusions generally rated easier and skeletal discrepancies, surgical cases and temporomandibular disorders rated most difficult (Table 3). These results are consistent with the 2025 CAT difficulty grading consensus, as well as with reports from other countries.[1,43]

In complex cases, CAT is limited by its dependence on aligner geometry and material properties.[42,44] As a result, sometimes the use of attachments, smaller staged movements and hybrid mechanics that combine aligners and fixed appliances are necessary.[42] Treatment planning should be individualised based on facial profile, diagnostic findings, 3D movement requirements and anticipated patient compliance.[1]

Aligner change intervals and recall schedules

Aligner change intervals and recall schedules are important considerations for optimising treatment efficiency, patient compliance and clinical outcomes in CAT. Globally, most clinicians suggest aligner changes every 7 to 14 days, but preferences differ.[11-13,15-17,24,45]

In the present survey, over half of Chinese clinicians chose 7- to 10-day change intervals and over one-third chose 10- to 14-day intervals. Current evidence suggests that longer wear protocols may have marginal benefits for some complex movements but are not consistently superior to shorter protocols across outcomes.[22,46,47] Accordingly, aligner change frequency should be individualised according to the complexity of the planned movements to optimise efficiency and control.

Regarding recall schedule, more than two-thirds of Chinese clinicians reported a recall schedule of 6 to 12 weeks, 36.49% opted for 6 to 8 weeks and 33.30% for 8 to 12 weeks. Internationally, most orthodontists reported organising recalls at 6 to 8 weeks.[12,13,15-17,24]

Recent trials indicate that remote monitoring can result in fewer and shorter in-office visits by continuously checking aligner fit and tooth movement.[48,49] Based on current evidence, a pragmatic approach is to adopt an aligner change protocol of 7 days with 8 to 12 weeks recall for mild to moderate cases and 10 to 14 days with 6 to 8 weeks recall for complex movements, such as distalisation and root control. Treatment protocols should be flexible and modified based on the biological response of the patient and clinical progress.

Comparison between CAT and fixed appliances

For the time period relevant to the present survey, fixed appliances still made up a larger percentage of the routine clinical workload.[50] Beyond market penetration, both international expert consensus and national guidelines focus on the indication boundaries and predictability limits of CAT. Aligners can be a good alternative to fixed appliances in Class I non-extraction cases with mild to moderate crowding, but extraction based management of severe crowding is more difficult due to issues associated with alignment, occlusal contacts and control of incisor torque and tipping.[35,51] Clinical evidence from first premolar extraction patients treated with aligners has documented clinically meaningful discrepancies between predicted and achieved movements, including anchorage loss and unwanted tipping or vertical changes of incisors, canines and molars.[34,52] The higher concentration of extraction cases treated with fixed appliances is therefore in line with these known biomechanical limitations of CAT.

Regarding treatment duration, a recent systematic review found low-certainty evidence of no consistent difference between aligners and fixed appliances for mild to moderate crowding, and an expert consensus did not conclude that CAT is consistently faster.[53] Statements on time efficiency should therefore be interpreted cautiously and put in context with case complexity and patient compliance. In the present survey, 50.28% of clinicians agreed that CAT is more time-consuming than other techniques whereas 38.56% were neutral and 11.17% disagreed, resulting in a mean score of 2.51 (on a 5-point scale, with higher scores indicating stronger agreement).

Limitations and generalisability

This study has several limitations. Voluntary participation via professional online networks may have introduced selection bias and limited representativeness. Many CAT users were low-volume providers, and analyses were not stratified by caseload or experience, so reported protocols may not reflect those of high-volume or specialised clinicians. Data were self-reported without external validation, introducing potential information bias, and the questionnaire, although expert reviewed and pilot-tested, was not formally psychometrically validated. Regional responses were uneven, with fewer from less developed areas, and the sampling frame was not enumerated, precluding calculation of a response rate and assessment of non-response bias. The cross-sectional design limits causal inference and

temporal analysis; outcomes were subjective without objective records and descriptive analyses without multivariable modelling precluded assessment of associations. Despite these limitations, the large sample and broad geographic coverage provide a useful snapshot of contemporary CAT practice in China, although generalisation should be cautious given differences in training, resources, sampling and regional representation.

Conclusion

This study found that 87.74% of Chinese dental practitioners have adopted CAT in clinical practice, mainly for mild to moderate malocclusion, and rarely in complex cases. Most clinicians reported aligner change intervals of 7 to 14 days, most often 7 to 10 days, and recall intervals of 6 to 12 weeks, most often 6 to 8 weeks. These results provide useful information for the clinical application and standardisation of CAT in China.

Conflicts of interest

The authors declare no conflicts of interest related to this study.

Acknowledgements

We thank the dental practitioners who participated in the survey and our departmental colleagues for their guidance and support throughout the study and manuscript preparation.

Author contribution

Dr Le Bei WANG contributed to the conception and design of the questionnaire, survey distribution, statistical analysis and drafting of the manuscript; Dr Ting DONG participated in the questionnaire design, distribution and data collection; Dr Nian Song YE contributed to the conception and design of the study, data analysis and critical revision of the manuscript; Drs Bing FANG and Lun Guo XIA contributed to the study supervision and critical revision of the manuscript.

(Received Aug 29, 2025; accepted Jan 6, 2026)

References

1. Wang Y, Long H, Zhao Z, et al. Expert consensus on the clinical strategies for orthodontic treatment with clear aligners. Int J Oral Sci 2025;17:19.
2. Tartaglia GM, Mapelli A, Maspero C, et al. Direct 3D printing of clear orthodontic aligners: Current state and future possibilities. Materials (Basel) 2021;14:1799.
3. Bae GS. Clinical limitations and its solutions of the clear overlay appliance treatment. J Korean Dent Assoc 2016;54:563–574.
4. Brezniak N, Wasserstein A, Protter N. Clear aligner biomechanical limitations: Anchorage and couple (torque) development. Angle Orthod 2023;96:615-616
5. Gogna N, Irving M, Nandhra K. Aligner orthodontics: A literature review. Orthod Update 2023;16:33-38.
6. Pariyatdulapak N, Churnjitapirom P, Srikhirin T, Viwattanatipa N. Bond strength of orthodontic buttons on clear aligner materials. Orthod Waves 2021;80:224-231.
7. Shetty SK, Wilson C, Kumar Y, Madhur V. Orthodontic treatment with clear aligners. Sch J Dent Sci 2021;8:230-233.
8. Mehta F, Mehta S. Aligners: The rapidly growing trend in orthodontics around the world. Indian J Basic Appl Med Res 2014;3:402–409.
9. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. Ann Intern Med 2007;147:573–577.
10. Elm E von, Altman DG, Egger M, et al. The STROBE reporting checklist. In: Harwood J, Albury C, Beyer J de, Schlüssel M, Collins G (eds). The EQUATOR Network Reporting Guideline Platform. The UK EQUATOR Centre; 2025. https:/resources.equator-network.org/guidelines/strobe/strobe-checklist.docx. Accessed 24 July 2026.
11. Abu-Arqub S, Ahmida A, Da Cunha Godoy L, Kuo CL, Upadhyay M, Yadav S. Insight into clear aligner therapy protocols and preferences among members of the American Association of Orthodontists in the United States and Canada. Angle Orthod 2023;93:417–426.
12. Meade MJ, Weir T, Seehra J, Fleming PS. Clear aligner therapy practice among orthodontists in the United Kingdom and the Republic of Ireland: A cross-sectional survey of the British Orthodontic Society membership. J Orthod 2024;51:120–129.
13. Meade MJ, Weir T. A cross-sectional survey of the use of clear aligners by general dentists in Australia. Clin Exp Dent Res 2024;10:e919.
14. d'Apuzzo F, Perillo L, Carrico CK, et al. Clear aligner treatment: Different perspectives between orthodontists and general dentists. Prog Orthod 2019;20:10.
15. Meade MJ, Weir T. A survey of orthodontic clear aligner practices among orthodontists. Am J Orthod Dentofacial Orthop 2022;162:e302–e311.
16. Vecchione C, Le Ven M, Lefebvre F, Bolender Y, Weir T, Meade M. Clear aligners in orthodontics: A French perspective within an international survey. 100th Congress of the European Orthodontic Society, June 2025.
17. Meade MJ, Weir T. Clear aligner therapy procedures and protocols of orthodontists in New Zealand. Aust Orthod J 2023;39:123–135.
18. Fiori A, Minervini G, Nucci L, d'Apuzzo F, Perillo L, Grassia V. Predictability of crowding resolution in clear aligner treatment. Prog Orthod 2022;23:43.
19. Bruni A, Ferrillo M, Gallo V, et al. Efficacy of clear aligners vs rapid palatal expanders on palatal volume and surface area in mixed dentition patients: A randomized controlled trial. Am J Orthod Dentofacial Orthop 2024;166:203–214.
20. Loberto S, Pavoni C, Fanelli S, Lugli L, Cozza P, Lione R. Predictability of expansion movements performed by clear aligners in mixed dentition in both arches: A retrospective study on digital casts. BMC Oral Health 2024;24:694.

21. Ma S, Wang Y. Clinical outcomes of arch expansion with Invisalign: A systematic review. BMC Oral Health 2023;23:587.
22. Inchingolo AM, Inchingolo AD, Carpentiere V, et al. Predictability of Dental distalization with clear aligners: A systematic review. Bioengineering (Basel) 2023;10:1390.
23. Li L, Guo R, Zhang L, Huang Y, Jia Y, Li W. Maxillary molar distalization with a 2-week clear aligner protocol in patients with Class II malocclusion: A retrospective study. Am J Orthod Dentofacial Orthop 2023;164:123–130.
24. Miranda EPD, Moreira-Santos LF, Tavares MC, Weir T, Meade MJ, Flores-Mir C. Clear aligner therapy practices among orthodontists practicing in Canada. Prog Orthod 2024;25:27.
25. De Felice ME, Nucci L, Fiori A, Flores-Mir C, Perillo L, Grassia V. Accuracy of interproximal enamel reduction during clear aligner treatment. Prog Orthod 2020;21:28.
26. Dahhas FY, Almutairi NS, Almutairi RS, et al. The role of interproximal reduction (IPR) in clear aligner therapy: A critical analysis of indications, techniques, and outcomes. Cureus 2024;16:e56644.
27. Zhang Y, Wang X, Wang J, et al. IPR treatment and attachments design in clear aligner therapy and risk of open gingival embrasures in adults. Prog Orthod 2023;24:1.
28. Kim K, Choi YK, Kim SH, Kim SS, Kim YI. Multi-step finite element simulation for clear aligner space closure: A proof-of-concept compensation protocol. Sci Rep 2025;15:22220.
29. Tang Z, He K, Shen Y, Yang Y, Li Y. Evaluating the effectiveness of clear aligner therapy in leveling the curve of Spee: A comparative study of extraction vs. non-extraction patients. BMC Oral Health 2025;25:629.
30. Elias KG, Sivamurthy G, Bearn DR. Extraction vs nonextraction orthodontic treatment: A systematic review and meta-analysis. Angle Orthod 2024;94:83–106.
31. Grand View Research. China clear aligners market size & outlook, 2030. https://www.grandviewresearch.com/horizon/outlook/clear-aligners-market/china. Accessed 24 July 2026.
32. Yin J, Zhang H, Zeng X, et al. Prevalence and influencing factors of malocclusion in adolescents in Shanghai, China. BMC Oral Health 2023;23:590.
33. Kenessey DE, Vlemincq-Mendieta T, Scott GR, Pilloud MA. An anthropological investigation of the sociocultural and economic forces shaping dental crowding prevalence. Arch Oral Biol 2023;147:105614.
34. Ren L, Liu L, Wu Z, et al. The predictability of orthodontic tooth movements through clear aligner among first-premolar extraction patients: A multivariate analysis. Prog Orthod 2022;23:52.
35. Society of Orthodontics CSA. Guidelines for clear aligner orthodontic treatment (2021). Zhonghua Kou Qiang Yi Xue Za Zhi 2021;56:983-988.
36. Balteau M, Lefebvre F, Kanter D, Wagner D, Bolender Y. Diagnosis and Treatment Procedures in French Orthodontic Practices. J Clin Orthod 2021;55.
37. Feng Q, Chu F, Chen R, Pan X. Effects of mandibular extractions with clear aligners: A finite element analysis. J Shanghai Jiaotong Univ (Sci) 2021;26:377–382.
38. Dai FF, Xu TM, Shu G. Comparison of achieved and predicted crown movement in adults after 4 first premolar extraction treatment with Invisalign. Am J Orthod Dentofacial Orthop 2021;160:805–813.
39. Yang Y, Yang R, Liu L, et al. The effects of aligner anchorage preparation on mandibular first molars during premolar-extraction space closure with clear aligners: A finite element study. Am J Orthod Dentofacial Orthop 2023;164:226–238.
40. Qiang R, Gao J, Wang Y, Wang W, Ma Y, Jin Z. Anchorage loss of the posterior teeth under different extraction patterns in maxillary and mandibular arches using clear aligner: A finite element study. BMC Oral Health 2024;24:1204.
41. Truong L, Weir T, Nguyen H, Freer E, Ong D. Mesiodistal tip expression of mandibular anterior teeth in patients with mandibular incisor extraction treated with Invisalign aligners. Am J Orthod Dentofacial Orthop 2024;166:538–548.
42. Upadhyay M, Arqub SA. Biomechanics of clear aligners: Hidden truths & first principles. J World Fed Orthod 2022;11:12–21.
43. AlMogbel A. Clear aligner therapy: Up to date review article. J Orthod Sci 2023;12:37.
44. Aminian A, Garino F, Castroflorio T, Younessian F. Biomechanics of tooth rotation in clear aligner therapy. Semin Orthod 2026;32:131–142.
45. Keim RG, Vogels DS III, Vogels PB. 2020 JCO study of orthodontic diagnosis and treatment procedures part 1: Results and trends. J Clin Orthod 2020;54:581–610.
46. Al-Nadawi M, Kravitz ND, Hansa I, Makki L, Ferguson DJ, Vaid NR. Effect of clear aligner wear protocol on the efficacy of tooth movement. Angle Orthod 2021;91:157–163.
47. Bichu YM, Weir T, Zou B, Adel S, Vaid NR. Clear aligner therapy concerns: Addressing discrepancies between digitally anticipated outcomes and clinical ground realities. Turk J Orthod 2024;37:130–139.
48. Lam J, Freer E, Miles P. Comparative assessment of treatment efficiency and patient experience between Dental Monitoring and conventional monitoring of clear aligner therapy: A single-center randomized controlled trial. Am J Orthod Dentofacial Orthop 2023;163:456–464.
49. Hansa I, Katyal V, Ferguson DJ, Vaid N. Outcomes of clear aligner treatment with and without Dental Monitoring: A retrospective cohort study. Am J Orthod Dentofacial Orthop 2021;159:453–459.
50. Dai QL, Wang WH. China clear aligner orthodontics industry annual insights report: Resilient growth under a stable duopoly structure [industry report, in Chinese]. Shanghai: China Insights Consultancy; 2024. https://www.cninsights.com/uploads/upload/files/20250224/2a769a0a66f44b336c2c8cea70680f0b.pdf. Accessed 24 July 2026.
51. D'Antò V, Ghislanzoni LTH, Huanca Ghislanzoni LT. Indications and limits of clear aligner therapy: an international modified Delphi consensus study. Prog Orthod 2025;26:28.
52. Song JH, Lee JH, Joo BH, Choi YJ, Chung CJ, Kim KH. Treatment outcome comparison of Invisalign vs fixed appliance treatment in first premolar extraction patients. Am J Orthod Dentofacial Orthop 2024;165:399–413.
53. Alhamwi AM, Burhan AS, Idris MI, Nawaya FR. Duration of orthodontic treatment with clear aligners versus fixed appliances in crowding cases: aAsystematic review. Clin Oral Investig 2024;28:249.