

Table S2. Summary of Key Outcomes from Included Studies

S.no	Study, Year, Country	Design	Outcome Measures
1.	Quinzi et al. (2023), Italy [12]	Controlled Retrospective cohort study	- The study compared skeletal and dental effects of severe crowding treatment by serial extractions or maxillary expansion in mixed dentition - Both treatment modalities significantly affected vertical skeletal parameters, decreasing mandibular inclination and occlusal plane inclination - A significant decrease in the superior part of the gonial angle was observed in both extraction groups - No significant differences were found in sagittal skeletal parameters between the groups at baseline - The annualized changes in the superior gonial angle significantly differed among the Control, EX, and EXP-EX groups - Dental parameters were considerably affected by treatment compared to untreated controls
2.	Dias et al. (2021), Brazil [13]	RCT	- Multi-arm RCT in early/mixed dentition compared four approaches for anterior open bite (AOB): bonded spurs (BS), chin cup (CC), fixed palatal crib (FPC), and removable palatal crib (RPC). - All appliances corrected AOB at end of treatment (T2); stability differed by appliance at 2-year follow-up (T3). - At T3, mean overbite (mm) indicated best stability with FPC ($\approx +1.23$ mm), followed by RPC ($\approx +0.73$ mm); BS showed minimal positive overbite ($\approx +0.19$ mm), while CC showed slight relapse to open bite (≈ -0.19 mm). - Retention to T3 was 63/99 analyzed (BS 15; CC 11; FPC 21; RPC 16); mean age at T3 ≈ 11.4–11.7 years. - No untreated control arm; between-group differences at T3 favored crib-based appliances (FPC/RPC) for overbite stability. - Heterogeneity in protocols/retention reporting limited appliance-specific secondary outcomes; overjet and skeletal (ANB) changes were not consistently sustained relative to dental overbite correction.
3.	Keski-Nisula et al. (2020), Finland [14]	Controlled Trial	- Class II treatment with an EGA significantly improved molar relationships, overjet, and overbite in early mixed dentition - The treatment group showed a decrease in Class II frequency from 100% to 14% during treatment - Overbite increased by 0.9 mm, while late crowding of lower incisors was observed in 14% of children - Mandibular length increased significantly more in the treatment group compared to controls - No children required a second treatment phase after early intervention - The results remained stable into early permanent dentition at age 16.7 years
4.	Myrland et al. (2014), Norway, Finland [15]	RCT	- The mean ICC for duplicate cephalometric measurements was 0.95, indicating high reliability - Significant decreases in overjet and overbite were observed in the treatment group

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			• Class II molar relationships decreased significantly in the treatment group • The number of children with impinging deep bite significantly reduced in the treatment group • No significant differences were found between treatment and control groups at T1 • Follow-up data are needed to assess long-term effects of the treatment • The study involved 48 children, with 46 completing the study.
5.	Lippold et al., 2013, Germany [16]	RCT	• The therapy group showed significant maxillary expansion in intercanine distance and transversal widths between T1 and T2 • The control group exhibited significant growth in intercanine distance and anterior transversal width • A very significant difference was noted between therapy and control groups for maxillary growth at T2 • The therapy group experienced a significant increase in basal arch length across all regions. • Midline deviation significantly improved in the therapy group, while it slightly increased in the control group • Vertical overbite increased significantly in the therapy group, contrasting with stability in the control group • Overall, orthodontic treatment improved dental occlusion and enhanced craniofacial growth prognosis
6.	Anne Mandall N et al. (2012),UK [17]	RCT	• The study found that early class III protraction facemask treatment resulted in significant improvements in ANB (1.5°) and overjet (3.6 mm) compared to the control group, which showed minimal changes. • The treatment group demonstrated a 21% improvement in the peer assessment rating (PAR), while the control group worsened by 8.4%. • However, there was no statistically significant increase in self-esteem or reduction in the psychosocial impact of malocclusion between the groups at the 3-year follow-up. • Overall, 70% of patients in the treatment group maintained a positive overjet, indicating ongoing treatment success.
7.	King et al. (2012), USA [8]	RCT	• The study found that initial orthodontic (IO) is effective at reducing malocclusions in Medicaid patients, but less so than Comprehensive orthodontic (CO) • At 48 months, CO showed significant improvements in PAR and ICON compared to IO. • IO had a mean reduction of 10.1 PAR points, while CO had 18.6 PAR points. • Both groups experienced significant reductions in need by 48 months, with CO showing less need than IO. • The dropout rate was 21%, which was less than expected. • Baseline characteristics of dropouts did not significantly differ from completers.

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8.	Baccetti et al. (2010), Italy [18]	RCT	• The study found a successful eruption rate of 80% for the RME/TPA/EC group and 79.2% for the TPA/EC group • A total of 40 subjects were in the RME/TPA/EC group, with 66 PDCs • The prevalence of successful eruption was significantly higher in treated groups compared to the control group • Dropouts did not affect the study's power, with three subjects relocating during the observation period • The success rate for RME/TPA or TPA treatment was 75%, similar to other methods • Unsuccessful cases showed more advanced root development compared to successful cases • The study concluded that TPA with deciduous canine extraction is an effective treatment for palatally displaced canines
9.	Jolley et al. (2010), USA [19]	RCT	• The interim report compares dental outcomes by evaluating PAR scores after interceptive treatment or observation • 81% of interceptive patients were no longer considered "medically necessary" for further treatment • Only 24% of interceptive patients achieved a 70% reduction in PAR score, indicating significant improvement • The study highlights the need for cost-effectiveness analysis between interceptive and comprehensive treatments • Results suggest that further analysis is required as the trial progresses and more data becomes available
10.	O'Brien et al. (2009), UK [6]	RCT	• Early treatment resulted in higher PAR scores at the end of treatment compared to later treatment ($P = 0.002$) • Patients receiving early treatment had significantly longer overall treatment times than those treated later ($P < 0.001$) • The cost of early treatment was approximately \$900 more than later treatment ($P < 0.001$) • There were no significant differences in skeletal pattern, extraction rates, or self-esteem between early and later treatment groups • Early treatment increased patient attendances and duration of treatment, leading to poorer final occlusion • The study concluded that early treatment offers minimal benefits over treatment starting in adolescence
11.	Keski-Nisula et al. (2008), Finland [20]	Prospective Controlled Cohort Study	• Eruption guidance appliance (EGA) treatment significantly reduced overjet and overbite. • 99% of treated children achieved tooth contact compared to 24% in the control group. • Class I canine and molar relationships were achieved in 90% of treated children versus 48% in controls. • Only 13% of treated children had occlusal deviations, compared to 88% in the control group. • Compliance issues were noted, with 31% of children discontinuing due to cooperation challenges. • Early intervention with EGA was effective in reducing long-term treatment need, especially when there was strong family support.

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12.	Krušinskienė et al. (2008), Lithuania, Finland [21]	Prospective Randomized Controlled Trial	- The study involved 68 children, with no significant differences in occlusal outcomes between HG treatment and control groups at 13 years follow-up - Lower PAR scores were noted in patients treated without extractions, indicating better outcomes in this group - The greatest irregularity in lower incisor alignment was found in subjects treated with extractions before treatment . - The study concluded that treatment timing has a minor influence on stability, with no significant differences in long-term aesthetics - The Peer Assessment Rating (PAR) Index effectively evaluated occlusal stability throughout the study
13.	Torres et al. (2006), Brazil [22]	RCT (Prospective Controlled Trial)	- The study found no intra-group sexual dimorphism between genders in either group - Only nine out of 34 analyzed variables showed statistically significant changes - The treated group had a mean AOB closure of 3.86 mm - The control group exhibited less extrusion and tipping of incisors compared to the treated group - No significant differences were observed in molar eruption or mesial movement - Dentoalveolar changes were significant, but soft tissue changes were not - The treatment resulted in an increase of overbite in all treated individuals
14.	Kau et al. (2004), Italy, Germany, Wales [23]	RCT	- Lower incisor crowding reduced by 4.76 mm more in the extraction group than in controls. - Arch length decreased by 2.73 mm in the extraction group, suggesting forward molar migration. - Only 1 in 20 extraction cases showed meaningful crowding improvement, questioning routine use. - Net space gain from primary canine extraction was 2.03 mm.
15.	Mäntysaari et al. (2004), Finland [24]	RCT	- Early headgear (HG) treatment significantly affects dental arches and craniofacial morphology in children with moderate crowding . - In the HG group, the mean treatment time was 8 months at T1 and 16.2 months at T2 - The control group underwent interceptive procedures, including extractions of primary canines in 38% and 35% of subjects, respectively - Interdental stripping was performed in 19% of patients in the control group - The results indicate a decrease in the SNA angle and increased anterior face height
16.	Tulloch et al. (2004), USA [5]	RCT	- Early treatment showed favorable growth changes in about 75% of children, but had little effect on subsequent treatment outcomes - By the end of phase 2, no significant differences were found among treatment groups for skeletal and dental measures - The average treatment time in fixed appliances was similar across groups, indicating no efficiency gain from early treatment - The percentage of children requiring extractions approached significance, but was not statistically different among groups

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			• Cooperation was not the major factor influencing treatment outcomes, suggesting other variables played a role • The study concludes that early treatment should not be considered efficient for most Class II children
17.	O'Brien et al., 2003, UK [25]	RCT	• The study involved 174 children with Class II Division 1 malocclusion, divided into treatment and control groups • Twin-block treatment significantly reduced overjet and severity of malocclusion • The treatment group showed a mean percentage reduction of 42% in PAR scores • Most corrections were due to dentoalveolar changes, with minor skeletal changes. • One patient in the control group was lost to follow-up, while 16% in the treatment group did not complete treatment • The initial discrepancy magnitude influenced treatment outcomes • The last data collection occurred in November 2000, 15 months post-treatment
18.	Tulloch et al. (1998),USA [10]	RCT	• Early treatment with headgear or functional appliances reduced skeletal discrepancies in children with Class II problems • 75% of treated children showed favorable skeletal responses, while 25% did not • No significant differences in jaw relationships or dental occlusion were found between early and later treatments • Treatment time in fixed appliances was shorter for early treatment, but total treatment time was longer when including phase 1 • Variability in treatment response was influenced by factors like compliance and clinician proficiency • The PAR scoring system indicated modest improvements in occlusion, with some patients experiencing worse outcomes • The skeletal effects of early treatment were not maintained after comprehensive treatment