Supplementary material



**Supplementary Fig. 1**. **Cephalometric parameters.** (A) Measuring points: 1, Nasion (N); 2, Orbitale (O); 3, Anterior nasal spine (ANS); 4, Posterior nasal spine (PNS); 5, point A (A); 6, point B (B); 7, Pogonion (Pog); 8, Gnathion (Gn); 9, Menton (Me); 10, Gonion (Go); 11, Tangent point of lower mandible margin (TPL); 12, Condylion (Co); 13, Porion (Po); 14, Sella (S); 15, Pterygomaxillary fissure (Ptm); 16, Upper central incisor tip (U1); 17, Upper central incisor apex (U1A); 18, Lower central incisor tip (L1); 19, Lower central incisor apex (L1A).

(B) Linear measurements (mm): 1, Ptm-A: distance between the vertical projected points of point Ptm and point A on the FH plane respectively; 2, Ptm-S: distance between the vertical projected points of point Ptm and point A on the FH plane respectively; 3, Co-Gn: distance between point Co and point Gn; 4, N-Me: distance between the vertical projected points of point N and point Me on the perpendicular line to the FH plane respectively; 5, N-ANS: distance between the vertical projected points of point N and point ANS on the perpendicular line to the FH plane respectively; 6, ANS-Me: distance between the vertical projected points of point ANS and point Me on the perpendicular line to the FH plane respectively; 7, S-Go: distance between the vertical projected points of point S and point Go on the perpendicular line to the FH plane respectively.

(C) Angular measurements (°): 1, SNA; 2, SNB; 3, ANB; 4, SGn–FH; 5, PP–FH; 6, MP–FH; 7, NPo–FH; 8, U1–SN; 9, L1–MP; 10, U1–L1.

Supplementary Table 1. Univariable linear regression analysis of relationship between the increment of maxillary length (Ptm-A) and two indicators of the treatment timing.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Unstandardized Coefficients | | Standardized  Coefficients | *t* | *p* | *R*2 |
| B | Std. Error | B |
| Cervical vertebral maturation stage | 0.237 | 0.181 | 0.133 | 1.311 | 0.193 | 0.018 |
| Dentition stage | 0.061 | 0.105 | 0.060 | 0.582 | 0.562 | 0.004 |

Supplementary Table 2. Characteristics of the clinical studies on optimal timing (dentition stage) of maxillary protraction in Class III malocclusion patients.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Publication | Treatment group (TG) | Control group (CG) | Treatment appliance | Total observation  time | Parameters |
| Baccetti (1998) | TG 1 (early mixed dentition, n = 23)  TG 2 (late mixed dentition, n = 23) | CG 1 (early mixed dentition, n = 17)  CG 2 (late mixed dentition, n = 15) | Facemask with maxillary expander | Treatment period excluding observation period | Annualized change |
| Baccetti (2000) | TG 1 (early mixed dentition, n = 16)  TG 2 (late mixed dentition, n = 13) | CG 1 (early mixed dentition, n = 17)  CG 2 (early mixed dentition, n = 11)  CG 3 (late mixed dentition, n = 15)  CG 4 (late mixed dentition, n = 10) | Facemask with maxillary expander | Treatment period including observation period | Annualized change |
| Franchi (1998) | TG 1 (early mixed dentition, n = 23)  TG 2 (late mixed dentition, n = 23) | CG 1 (early mixed dentition, n = 17)  CG 2 (late mixed dentition, n = 15) | Facemask with maxillary expander | Treatment period excluding observation period | Annualized change |
| Franchi (2004) | TG 1 (early mixed or late deciduous dentition, n = 33)  TG 2 (late mixed dentition, n = 17) | CG 1 (early mixed dentition, n = 14)  CG 2 (late mixed dentition, n = 10) | Facemask with maxillary expander | Treatment period excluding observation period | Actual change |
| Kajiyama (2004) | TG 1 (deciduous dentition, n = 34)  TG 2 (early mixed dentition, n = 29) | CG 1 (deciduous dentition group, n = 32)  CG 2 (early mixed dentition, n = 25) | Maxillary protractor bow appliance | Treatment period excluding observation period | Annualized change |
| Lee (2010) | TG 1 (deciduous dentition, n = 26)  TG 2 (mixed dentition, n = 23) | - | Facemask without maxillary expander | Treatment period including observation period | Actual change |

Annualized change = 12 × Actual change/Treatment period (in months).