Supplementary material

Supplementary Table 1. Data charting.

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| First author, year (country) | Aim and interventions | Outcomes and conclusions |
| Gu, 2000 (Hong Kong)[25] | Aim to compare the skeletal and dental changes during the correction of Class III between 2 × 4 Appl (Exp group) and reverse headgear or facemask (Ctrl group).  - Non-randomized CCT with parallel groups.  - Exp: 17 children (mean age 9.7 years). Four brackets (“0.018” slot). WS: 0.016 NT, 0.016 SS, and 0.016 × 0.022 TMA.  - Ctrl: 20 children (mean age 8.5 years). | - The reduction of overjet was on average:  - 2 × 4 Appl = 5.2 mm  - Reverse Headgear = 6.5 mm  - This difference was not statically significant (*p* > 0.05).  - The 2 × 4 Appl produced only dental changes (proclination movements), whereas reverse headgear produced both dental and skeletal changes. |
| Fiona, 2001 (UK) [12] | Aim to present four cases using the 2 × 4 Appl  - Case 1: Anterior crowding. WS: 0.016 NT, 0.016 SS, and 0.018 SS. AT: 8 m.  - Case 2: Mild Class III malocclusion. WS: 0.016 NT, 0.018 × 0.025 NT, and 0.019 × 0.025 SS. AT: 8 m.  - Case 3: Retained primary upper left central incisor and two intraosseous supernumeraries. WS: 0.016 NT, 0.018 × 0.025 NT, and 0.019 × 0.025 SS. AT: 10 m.  Case 4: Unilateral posterior crossbite. WS: 0.016 NT, 0.018 × 0.025 NT, and 0.018 SS. AT: 13 m. | - Retainers were placed in all cases.  - The presented cases demonstrated the versatility of the 2 × 4 appliance. |
| Dowsing, 2004 (UK) [13] | Aim to describe four clinical cases using the 2 × 4 Appl  - Case 1: Retroclined upper central incisors. WS: 0.016 NT, and 0.016 SS. AT: 4 m. No retainer was used.  - Case 2: Impacted teeth. WS: 0.016 NT, 0.018 × 0.025 NT, 0.019 × 0.025 SS, and 0.018 SS. AT: 10 m.  - Case 3: Rotated and malaligned upper incisors. WS: 0.016 NT, 0.018 × 0.025 NT, and 0.019 × 0.025 SS. AT: 13 m.  Case 4: Unilateral posterior and central incisor crossbite. WS: 0.016 NT only; with a soldered quad-helix. AT: 5 m. | - A functional improvement and an obvious psychological benefit were accomplished with the 2 × 4 appliance; it has demonstrated significant advantages over traditional removable therapies. |
| da Silva Filho, 2006 (Brazil/Spain) [10] | Aim to present a brief narrative literature review and a representative clinical case report.  - Case: Maxillary anterior crowding. WS: 0.016 NT, 0.016 SS, 0.018 SS, and 0.020 SS. | - Posterior omegas were made up in the SS wires, mesially to molar tubes.  - A removable Howley-type appliance was used as a retainer for 6–12 months. |
| Agarwal, 2011 (India) [26] | Aim to describe two clinical cases using the 2 × 4 Appl for treating anterior crossbites during the mixed dentition phase.  - Case 1: One crossed central incisor. Four Begg’s brackets. WS: 0.014 NT only. No retainer was used, only a fixed transpalatal arch. AT: less than 1 m.  - Case 2: Crossed upper right incisors. Four Begg’s brackets. WS: 0.014 NT only. AT: 1 m. | - Both treated cases achieved satisfactory and stable results in a short time. |
| Singhal, 2015 (India) [14] | Aim to describe four clinical cases treated with the 2 × 4 Appl for different malocclusions.  - Case 1: Malaligned upper permanent incisors; tooth 11 with severe rotation due to an intraosseous mesiodens. Four MBT Roth brackets and a bonded lingual button for derotations elastics. WS: 0.012 NT, 0.016 NT, and 0.017 × 0.025 SS, and 0.019 × 0.025 SS. AT: 11 m.  - Case 2: Severe anterior incisor crowding. WS: 0.014 NT, 0.016 NT, 0.017 × 0.025 NT, and 0.017 × 0.025 SS. AT: 7 m.  - Case 3: Upper midline diastema. WS: 0.016 NT, 0.017 × 0.025 NT, 0.017 × 0.025 SS, and 0.019 × 0.025 SS. Elastomeric chains were used. AT: 6 m.  - Case 4: Moderate anterior crowding with a rotated central incisor; a bonded lingual button on the rotated incisor. WS: 0.012 NT, 0.016 NT, 0.017 × 0.025 NT, and 0.019 × 0.025 SS. AT: 10 m. | - The 2 × 4 Appl was adequate for the correction of rotated teeth, midline diastema, and retroclined incisors.  - This is an excellent early orthodontic therapy to help patients with self-esteem concerns, instead of waiting for the full permanent dentition. |
| Wiedel, 2015 (Sweden) [27] | Aim to compare the effectiveness of multi-bracket appliances (Exp group) and removable plates (Ctrl group) in correcting anterior crossbite with a functional shift in the mixed dentition.  - A RCT with parallel arms. Randomized assignment through the technique of blocks of 10.  - Exp: 17 children (mean age 9.7 years). SS brackets (“0.022” slot). WS: 0.016 heat-activated NT, 0.019 × 0.025 heat-activated NT, and 0.019 × 0.025 SS. Bonded composite bite blocks on the occlusal surfaces of both lower primary second molars.  - Ctrl: 20 children (mean age 8.5 years). Removable acrylic plate with protruding springs. | - The crossbite was successfully corrected in all patients in the Exp group, and all except one in the Ctrl group.  - Average AT was statically shorter (1.4 m) in the Exp group.  - Significant increases in arch length and overjet in both groups, but significantly higher in the Exp group. |
| Yordanova, 2016 (Bulgaria) [28] | Aim to describe three clinical cases treated with the 2 × 4 Appl for anterior crossbite treatment.  - In all the cases, occlusal caps with an attached transpalatal arch were also placed; instead of placing bands, anchor tubes were bonded to the vestibular surfaces of the caps. Three NT wires were used.  - Case 1: Crossbite between upper and lower permanent incisors. WS: Not mentioned. AT: 1 m.  - Case 2: Crossbite of central incisors and deep bite. WS: Not mentioned. AT: 3.5 m.  - Case 3: Crossbite of central incisors. WS: Not mentioned. AT: 3 m. | - The quick treatment results contribute to the normal skeletal orofacial complex growth.  - Orthodontic therapy should be implemented in the early mixed dentition stage, before the beginning of the pubertal growth peak. |
| Harika, 2016 (India) [29] | aim to describe the clinical treatment for the correction of an anterior malocclusion through the 2 × 4 Appl.  - Case: Midline diastema and rotated central incisors. Four metallic MBT brackets. WS: Not mentioned. A labial frenectomy and a circumferential supracrestal fibrotomy were also performed. AT: 3 m. | - Functional and psychological benefits from early orthodontic therapy with a simple and easily placed 2 × 4 appliance provide significant advantages over removable devices. |
| Sunil, 2017 (India) [30] | Aim to present the orthodontic treatment for the correction of anterior crossbite using the 2 × 4 Appl.  - Case: Upper left permanent incisor in crossbite. Four “0.022” preadjusted edgewise brackets slot. WS: 0.014 NT and 0.017 × 0.022 NT. Bite blocks were bonded to the occlusal surfaces of both lower first permanent molars. AT: 1 m. | - The anterior sectional twin bracket device is reliable and effective for the correction of a single incisor crossbite with a shorter treatment duration. |
| Rohilla, 2017 (India) [1] | Aim to describe three clinical cases treated with the 2 × 4 Appl for treatment of different malocclusions.  - Case 1: Anterior crowding and retained primary incisors. WS: 0.012 NT, 0.016 NT, 0.017 × 0.025 NT, and 0.017 × 0.025 SS. An acrylic bite plane was also placed. AT: 9 m.  - Case 2: Malaligned upper incisors with inadequate axial inclinations and increased overjet. WS: 0.014 NT, 0.017 × 0.025 NT, and 0.017 × 0.025 SS. AT: 8 m.  - Case 3: Spacing between permanent anterior teeth. WS: 0.014 NT, 0.017 × 0.025 NT, and 0.017 × 0.025 SS. Elastic chains were used for space closure. A labial frenectomy was also performed. AT: 8 m. | - When used adequately, the 2 × 4 appliance provides more controlled orthodontic forces to tooth movement, with more predictable outcomes. |
| Solanki, 2017 (India) [4] | Aim to present two clinical cases of correction of malpositioned permanent upper anterior teeth through the use of the 2 × 4 Appl.  - Case 1: Upper incisors in a proclined position with poor esthetics, and the presence of an intraosseous mesiodens. WS: 0.014 NT and 0.016 × 0,025 SS. AT: 5 m. A fixed lingual retainer was placed.  - Case 2: Severe anterior crowding. WS: 0.012 NT, 0.014 NT, 0.016 NT, and 0.016 × 0.025 SS. AT: 5 m. | - The treatment objectives were quickly and easily achieved within a short span, avoiding thus a more complex and prolonged treatment in the future. |
| Nagarajan, 2018 (India) [15] | Aim to present three clinical cases with anterior crossbite and tooth crowding using the 2 × 4 Appl.  - Case 1: Three upper incisors in crossbite with slight vestibular enamel attrition. Four “0.022” edgewise brackets. WS: 0.014 NT and 0.016 NT. AT: 3 m.  - Case 2: Single tooth crossbite (#11) with gingival recession. “0.022” preadjusted edgewise brackets with an anterior fixed glass ionomer cement bite-plane. WS: 0.014 NT only. AT: less than 1 m.  - Case 3: Both upper lateral incisors were in crossbite and behind the central incisors. Four preadjusted edgewise brackets. WS: 0.014 NT and 0.016 NT. Primary upper canines were previously extracted. AT: 3 m. | - Anterior crossbite and moderate/severe malpositioned teeth during the early mixed dentition can be corrected with the 2 × 4 appliance, exhibiting quick results in less than 2 or 3 months of treatment in most cases. |
| Soni, 2019 (India) [9] | Aim to present three cases with different malocclusions treated by 2 × 4 Appl.  - Case 1: Anterior crowding and tooth rotations. WS: 0.014 NT, 0.017 × 0.025 NT, 0.017 × 0.’025 SS. AT: 3 m.  - Case 2: Malpositioned anterior teeth. WS: 0.014 NT, 0.016 NT, 0.017 × 0.025 NT, 0.017 × 0.025 SS. Elastic chains were placed. AT: 2 m.  - Case 3: Anterior crowding. Brackets “0.022” slot. WS: 0.014 NT and 0.017 × 0.023 NT. Glass ionomer cement bite planes were placed on the occlusal surface of both mandibular permanent first molars AT: 2 m. | - The appliance offers tooth bodily movements if space needs to be created or recreated, derotation of incisors, and palatal root torque to decrease the chance of relapse. |
| Das, 2020 (India) [17] | Aim to present three clinical cases with anterior crossbite treated with the 2 × 4 Appl.  - Case 1: Crossbite and anterior crowding. WS: 0.014 NT, and 0.016 NT. An acrylic bite plane was also placed. AT: 1 m.  - Case 2: Anterior crossbite. WS: 0.014 NT only. Glass ionomer cement bite planes were placed on the occlusal surface of both mandibular permanent first molars. AT: 1 m.  - Case 3: Anterior crossbite of 12 and 22. Preadjusted edgewise brackets “0.022” slot. WS: 0.014 NT and 0.016 NT. Upper primary canines were extracted for space-gaining reasons. AT: 3 m. | - The here highlighted cases demonstrated that anterior crossbite can be successfully treated at the early mixed dentition phase, in a relatively short period. |
| Kumari, 2020 (India) [16] | - Aim to describe three cases of correction of malpositioned upper incisors using the 2 × 4 Appl.  - Case 1: Palatally placed (crossbite) of lateral incisors and central incisors in an edge-to-edge relationship. WS: “0.022” brackets. 0.012 NT, 0.014 NT, 0.016 NT, and 0.019 × 0.025 SS. Glass ionomer bite planes were placed. AT: 4 m.  - Case 2: Impacted right central incisor. “0.022” brackets. WS: 0.012 NT, 0,014 NT, 0.016 NT, and 0.019 × 0.025 SS. AT: 7 m.  - Case 3: Anterior crowding. Brackets “0.022”. WS: 0.014 NT and 0.016 NT. AT: 4 m. | - Identifying and managing malocclusions at an early stage can help achieve long-term stability in the treatment outcomes. |
| CCT = Controlled Clinical Trial  RCT = Randomized Controlled Clinical Trial  WS = Wire Sequence  NT = Nickel Titanium (NiTi)  SS = Stainless Steel  AT = Active Treatment (time in months) | | |