CASE REPORT

# Nonsurgical Orthodontic Treatment in an Adult with Skeletal Class III Malocclusion Using Passive Self-ligating System: A Case Report

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## ABSTRACT

Skeletal Class III malocclusion treatment is complex, especially when jaw deviations are serious. Camouflage treatment of skeletal Class III malocclusion improves prognosis with a slight-to-moderate functional shift. This report presents the case of a 23-year-old male with poor facial esthetics associated with chin protrusion and an uncomfortable bite. He had a concave profile, unfavorable incisor displays, protrusive lower lip, and strained lip closure. Camouflage therapy with a passive self-ligating (PSL) system through the anterior teeth of the maxilla protraction and arch expansion was used. After 14 months of treatment, the overjet outcome was positive. The teeth were arched, asymmetry was addressed, the convex profile and no deviation occurred when the jaw was closed. Factors in using the PSL system were low friction between the bracket and archwire, torque selection, and the significant dental arch expansion ability. The PSL system is an appropriate option in treating adults with skeletal Class III malocclusion to achieve a normal occlusion and a pleasant facial profile.

*Keywords: skeletal Class III, camouflage, passive self-ligating*



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## INTRODUCTION

Malocclusion is the misalignment of teeth and the misalignment of the upper and lower arches. It is the third most frequent oral health issue worldwide, and it is linked to poor oral hygiene, periodontal disease, TMJ disorders, speech issues, mouth breathing, and other issues. Malocclusion is a global dental problem with various degrees of impact on those who are affected. Class III malocclusion is when the buccal groove of the lower first permanent molar is mesial to the mesiobuccal cusp tip of the upper first permanent molar by the size of one or more bicuspid teeth.[1] Class III malocclusion is a less common clinical issue than Class II or Class I malocclusion, affecting fewer than 5% of the US population. It is high in Asia, owing to the high proportion of individuals with maxillary insufficiency, which reaches 9% of the Indonesian population.[2] Class III malocclusion is a disorder in which the skeletal and dental components are involved in the process, either anteroposteriorly or vertically. Dental characteristics can be shown by retroclined mandibular incisors, proclined maxillary incisors, edge-to-edge incisor relationship, and negative overjet. At the same time, skeletal Class III malocclusion can be caused by a lack of maxillae, an overgrowth of mandibles, or a combination of the two.[3] Tweed further defined Class III malocclusions as a pseudo Class III malocclusion with a normal mandible and underdeveloped maxilla (category A) and a skeletal Class III

malocclusion with a prognathic mandible or underdeveloped maxilla (category B).[4]

In adult patients, combined surgical orthodontic treatments are recommended for treating skeletal Class III malocclusion. However, it may not always be possible because of surgical risks and budgetary restrictions. Thus, camouflage can be considered a mild or moderate skeletal Class III malocclusion treatment choice. It is critical to distinguish between surgical and nonsurgical patients; however, this can be difficult in borderline cases. Some cephalometric variables have been defined to aid in the decision-making process. These variables include soft tissue profile, amount of anteroposterior disparity (ANB angle), angle of inclination of the lower incisors (IMPA), and other cephalometric variables such as incisor inclination.[5] The use of a passive self-ligating (PSL) system may be an appropriate option for nonsurgical options because of low friction between the bracket and the archwire, good torque control, and potentially induce a significant and stable dental arch expansion.[6]

The treatment objective is to eliminate early contacts between the upper and lower incisor teeth, promote early intermaxillary anchorage, and enhance the occlusion profile. A clockwise rotation of the mandible is frequently necessary to enhance face convexity, chin prominence, and occlusal relationship in adults with Class III malocclusion. In addition to using intermaxillary elastic, clockwise rotation of the mandible also helped improve the profile, smile, and occlusal alignment. This paper aimed to present a strategy for camouflaging a skeletal Class III malocclusion in an adult patient using the PSL system and clockwise rotation of the mandible.

## CASE REPORT

### Case and treatment planning

A 23-year-old Asian male presented to the Universitas Gadjah Mada Dental Hospital with a complaint about the forward look of his lower jaw and functional discomfort due to an unpleasant bite (underbite). He had never had an orthodontic consultation before and wanted to enhance the appearance of his teeth.

The patient has consented to have the photos and other clinical information published. He acknowledged that his name and initials would not be publicized and that reasonable attempts would be made to conceal his identity.

Extraoral examination (Figure 1) revealed a proportional but asymmetrical face, a dolichofacial appearance with competent lips, and chin deviation to the right. He also had a concave face profile, protrusive lower lip, retrusive upper lip, normal swallowing and speech function with no bad habits.

Intraoral clinical examination showed moderate oral hygiene with no tooth mobility. An anterior crossbite with a –3.85 mm overjet, a +4.03 mm overbite, and full-unit Class III molar and canine relationships bilaterally was detected. Findings included caries at tooth 26; supernumerary 22; and a steep curve of Spee. All teeth were erupted except the third molars, with a maxillary midline deviation of 1.07 mm to the right and a mandibular midline deviation of 2.89 mm to the right. The maxillary arch was distracted with moderate crowding (arch length discrepancy –4.96 mm), whereas the mandibular arch showed slight anterior crowding (arch length discrepancy –1.89 mm). The skewness of both arches was revealed (Figure 2). The existence of a forward mandibular displacement when the upper and lower incisors entered an edge-to-edge relationship during closure in centric relation was the critical factor for this


**Figure 1.** Pretreatment extraoral photographs: **(A)** frontal view at rest, **(B)** during a smile, and **(C)** lateral view profile.

case. This forward mandibular position enhanced the Class III malocclusion look and showed an excellent possibility for attempting camouflage treatment.

A Class III malocclusion skeletal pattern with a prognathic mandibular, vertical growth pattern, concave profile, decreased interincisal angles, and retrusive upper lip with protrusive lower lip was shown on the initial lateral cephalometric radiograph (Figure 3). Panoramic radiograph showed a normal alveolar bone height, supernumerary teeth #22, and four completely erupted third molars (vertical position) (Figure 3).

Functional examination revealed that this patient's centric occlusion (CO) and centric relation (CR) differed. CR evaluation demonstrated the edge-to-edge relationship between the upper and lower incisors with an overjet of 0 mm. Thus, the camouflage procedure was selected for treatment. Camouflage techniques carried out by the maxillary anterior region's protraction and intrusion considered the inclination of a maxillary incisor. There was no consideration for surgical options, extractions (besides supernumerary teeth), or advanced equipment and mechanics. The patient was denied on the first visit since they were deemed excessive. Due to the absence of growth potential in this clinical case, the treatment options were limited to camouflaging therapy by extending the maxillary arch and protracting the maxillary anterior teeth using PSL appliances. Options include orthodontic surgery and extraction therapy. The chin prominence in this situation does not necessitate orthognathic surgery. Similarly, extraction therapy was unnecessary because the mandibular arch was not crowded, and extraction of the supernumerary (maxillary left lateral incisor) was to correct the moderately crowded maxillary incisors.

**Figure 2.** Pretreatment intraoral photographs.

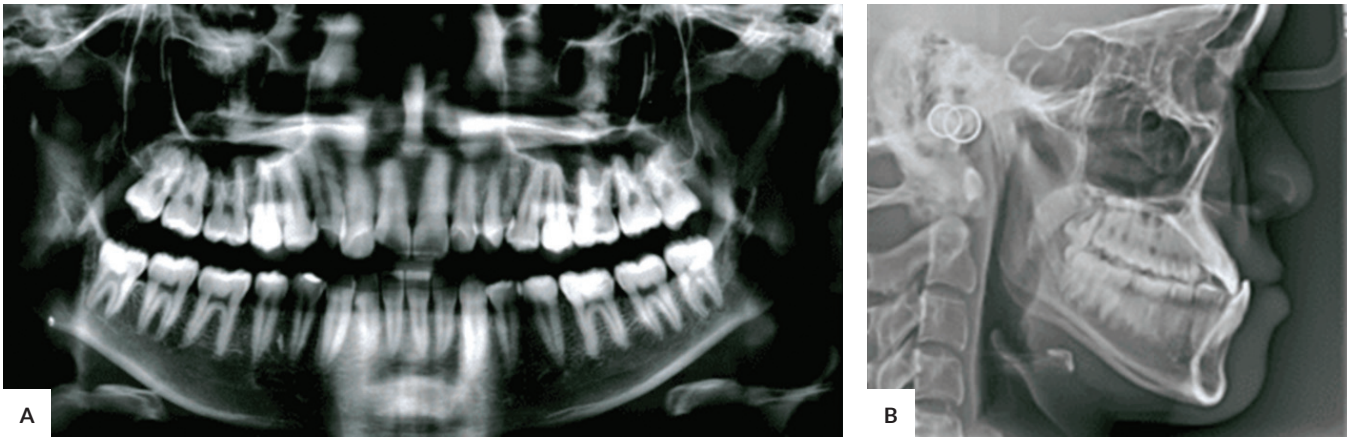


**Figure 3.** Pretreatment **(A)** panoramic radiographs and **(B)** lateral cephalometric.

## Treatment progress

The decision was made to attempt camouflage treatment using the passive self-ligating appliance (Damon 3MX, Ormco, California, USA) with early light Class III elastics and non-extraction. The standard torque bracket prescription was employed in the maxilla and the mandible. Direct bonding of brackets on both arches, including the lower 7s, commenced treatment. An inverted upper incisor bonding bracket (reversing the torque) was used to apply additional labial root torque for #12, #11, #21, and #22 correction. Changing the prescription torque from positive to negative by inverting the maxillary incisor brackets will exert labial root torque on these teeth, resulting in proper labiolingual inclination.

The initial disocclusion was performed by applying posterior bite raisers on the mandibular posterior teeth using composite resins. The patient was instructed to use the early light Class III intermaxillary elastics (5/16-inch, 2 oz) from the initial appointment. During the initial phase, the upper and lower 0.013" copper-nickel-titanium (CuNiti) archwire was fully engaged in both arches. Positive overjet (1 mm) was achieved within four months of treatment, and a 0.018" CuNiti archwire was completely ligated to both arches. A 0.014" × 0.025" CuNiti followed by a 0.018" × 0.025" CuNiTi were used on both arches (Figure 4). After nine months of treatment, leveling alignment was accomplished; bite raisers were removed, but Class III elastics were still utilized. An upper 0.019" × 0.025" stainless steel archwire with a lower 0.017" × 0.025" stainless steel archwire was the last archwire. Midline shifting was corrected using diagonal elastics. In the last stage (finishing and detailing phase), v-settling and box elastics were employed to adjust the occlusion and help fix the interdigitation bilaterally.

## Treatment results

Before the three-month stabilization phase, the appliances were debonded, and Essix retainers were utilized to maintain outcome stability. Mandibular third molars were recommended and were subsequently removed. The total treatment time was approximately 14 months. Within nine appointments, the treatment outcome showed a negative overjet correction (anterior crossbite) ranging from −3.85 mm to +2.03 mm, a deep overbite of +4.03 mm to +2.02 mm, a moderate crowding correction in the maxilla and mild on the mandible, a midline shift correction, a flat curve of Spee, and a class III to class I canine and molar relationship (Figure 5). The patient's facial aesthetics improved, creating an appealing smile and a typical soft tissue profile (Figure 6).

Posttreatment cephalometric radiograph analysis improved skeletal and dental parameters (Table 1), which enhanced the patient's facial esthetics and dental occlusion. The changes included clockwise rotation of the lower jaw, reduced ANB angle from −6° to −2°, and improved angle of convexity from −6° to 0°. Lower face height was somewhat raised, with the maxillomandibular plane angle rising from 26° to 28°. Furthermore, the Wits appraisal improved significantly from −8.85 mm to −1 mm. Proclination maxillary incisor was noted for obtaining a normal overjet, indicated by rising upper incisor to a maxillary plane angle from 106° to 113°. In contrast, the mandibular incisor to mandibular plane angle decreased from 92° to 89°. The interincisal angle also improved from 127° to 134°. Soft tissue analysis showed improved upper and lower lip profiles (Figure 7). Those alterations were validated by lateral cephalometric superimpositions (Figure 8). A posttreatment panoramic radiograph (Figure 7) showed that the roots were paralleled correctly and that there was no evidence of significant root or bone resorption.

**Figure 4.** Patient's intraoral photographs (during treatment).

**Figure 5.** Posttreatment intraoral photographs.

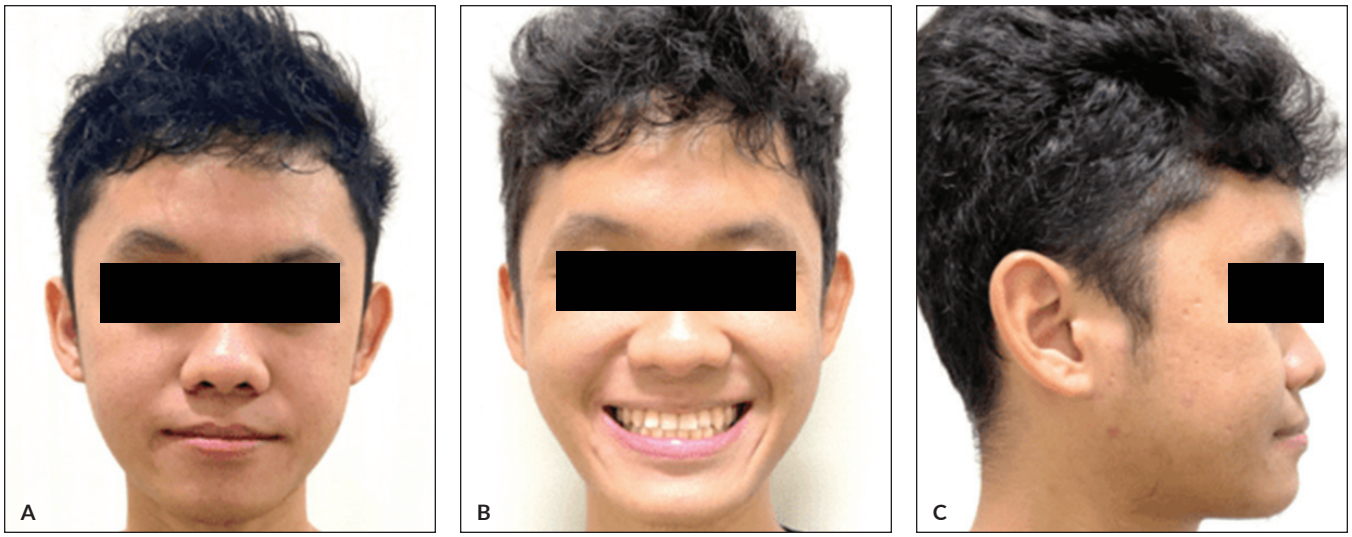


**Figure 6.** Posttreatment extraoral photographs: **(A)** frontal view at rest, **(B)** during a smile, and **(C)** lateral view profile.

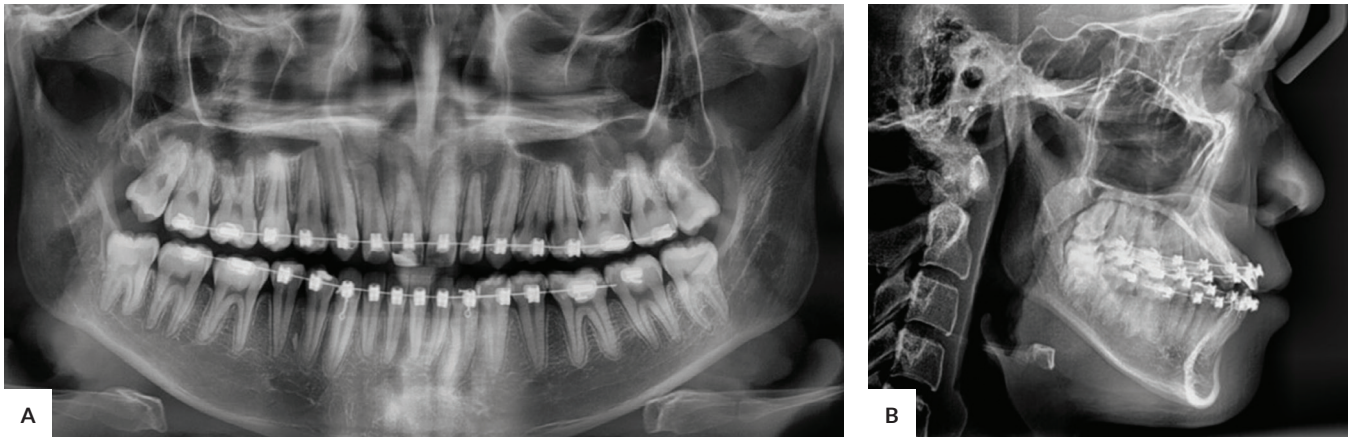


**Figure 7.** Postreatment **(A)** panoramic radiographs and **(B)** lateral cephalometric.

**Table 1.** Lateral cephalometric measurements

| Parameters | Normal (mean ± SD) | Pretreatment | Pre-debonding |
|---|---|---|---|
| ***Horizontal skeletal*** | | | |
| SNA (°) | 82 ± 2 | 82 | 82 |
| SNB (°) | 80 ± 2 | 88 | 84 |
| ANB (°) | 2 ± 2 | −6 | −2 |
| Wits appraisal (mm) | 1 ± 1 | −8.85 | −1 |
| Angle of convexity (°) | 0 ± 5 | −6 | 0 |
| ***Vertical skeletal*** | | | |
| Y-axis (°) | 60 ± 4 | 60 | 60 |
| SN-mandibular plane (°) | 32 ± 3 | 29 | 29 |
| MMPA (°) | 27 ± 5 | 26 | 28 |
| LAFH (%) | 55 ± 2 | 53 | 55 |
| ***Dental*** | | | |
| Interincisal angle (°) | 135 ± 10 | 127 | 134 |
| U1-palatal plane (°) | 109 ± 6 | 106 | 113 |
| U1-NA (mm) | 4 ± 2 | 3 | 6 |
| L1-mandibular plane (°) | 90 ± 4 | 91 | 89 |
| L1-NB (mm) | 4 ± 2 | 5 | 4 |
| ***Soft tissue*** | | | |
| Upper lip – E Line (mm) | 1 ± 2 | −6 | −3 |
| Lower lip – E Line (mm) | 0 ± 2 | 3 | 0 |

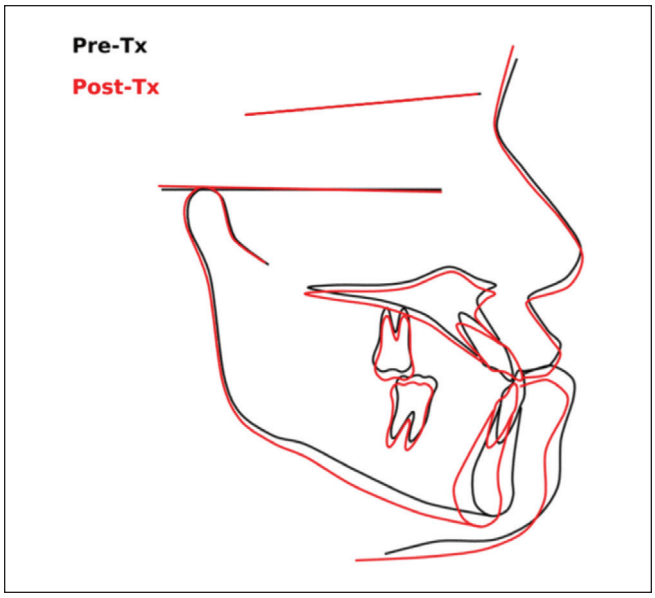


**Figure 8.** Superimposition of lateral cephalometric tracings; Black lines indicate tracing before treatments (Pre-Tx), whereas red lines indicate tracing after treatments (Post-Tx).

## DISCUSSION

Adults with skeletal Class III malocclusions typically require orthognathic surgery and orthodontic treatments. A genuinely orthognathic case cannot be changed into a non-orthognathic case under any circumstances; nevertheless, clinically and practically speaking, self-ligating devices – when utilized correctly – are much more effective at completing specific tooth movements than conventional fixed ones. Thus, self-ligating systems are extremely useful in such borderline cases, as in this case. This case illustrates the wide range of camouflage treatment options in adults with borderline Class III malocclusion. Camouflage treatment, in this case, aims to provide acceptable occlusion, function, and face attractiveness using dentoalveolar compensation. Camouflage techniques were chosen for this patient because functional examination revealed that the CO and the CR were different. The anterior edge-to-edge relationship was exhibited by CR analysis. Thus, camouflage treatment was considered the best treatment option.[7]

Proclination of the upper incisor and retroclination of the lower incisor is common in camouflage treatment of Class III malocclusion without extraction, resulting in an unstable treatment outcome. Using a PSL system to decrease the flaring effects of upper incisor teeth by lateral expansion of the posterior area has become a suitable alternative. The PSL device increases the maxillary transverse dentoalveolar width significantly.[8,9] This phenomenon could be explained by the theory that the PSL system increases the interpremolar and intermolar widths because of the combination of decreased sliding resistance and the broad CuNiTi archwires.[10,11]

The enhancement of copper in CuNiTi archwires reduces hysteresis, leading to the formation of consistent forces for long periods during deactivation, both of which are biologically beneficial to tooth movement.[12] Furthermore, the addition of copper (an effective heat conductor) to nickel and titanium results in well-defined transition temperatures, causing homogeneous loadings from one side of the wire to the other and fast and efficient tooth movement.[13]

Compared with superelastic NiTi and conventional heat-activated NiTi wires, CuNiTi archwires have a lower elasticity module. Specifically, they encounter deformations before lower activation loadings, presenting a high capacity to fit brackets of misplaced teeth, with less patient discomfort and a lower potential for tooth resorption.[12] A clinical study discovered through computed tomographic scans that arch expansion by the PSL system can be achieved not only through lateral tooth movement, which expands the inter-canine, interpremolar, and intermolar widths, but also through alveolar bone remodeling after tooth movement.[14]

To prevent additional proclination on maxillary incisor teeth, we also reversed the maxillary incisor bracket position for applying extra root torque to the upper incisors. Damon brackets with regular prescription have a torque value of +15˚ for the upper central incisors and +6˚ for the lateral incisors. When the brackets were reversed, the torque values for the upper central and lateral incisors were adjusted to –15˚ and –6˚, respectively. As a result, the upper incisors were subjected to more labial root torque. A previous study obtained the same results by reversing the bracket position with Damon brackets.[7]

The PSL system also has the advantages of early torque control and various pretreatment mechanisms that corrected the incisor inclination and obtained an excellent occlusion after the interference factor was eliminated. The posterior resin turbo was placed immediately on the supporting cusps of the first mandibular molars to function as a bite riser, providing a plane against which the opposing arch's teeth can touch when brought together for occlusion. Bite risers may be beneficial in treating anterior crossbite to minimize occlusal interferences, reduce CR-CO discrepancy, and enable unrestricted tooth movement by preventing undesired orthodontic bracket breaking.[15]

The early light elastic mechanism, which is one of the benefits of the self-ligating system, was used, with class III elastic from 16–43 and 26–33. This technique was performed to ensure that the canine and molar relationships were in class I from the start of treatment. Class III light elastics were also used to prevent the posterior maxillary teeth from extruding, which might cause the mandible to rotate clockwise backward and downward and thus improve the maxillomandibular skeletal relationship in the sagittal dimension, increasing the lower anterior facial height.[16] This rotation plays a significant role in creating an anterior overjet improvement.

In this case, we also discovered a slight decrease in the lower incisor inclination toward the conclusion of therapy, which might be related to the use of Class III light elastics. Mandibular incisor retroclination is used to obtain normal occlusion in Class III malocclusion camouflage treatment.[17]

A systematic review concluded that PSL brackets could induce slightly less incisor proclination (approximately 1.5˚) than conventional brackets.[18] Another research found no difference in incisor inclination following treatment between Class III surgical and camouflage groups; both groups had mandibular incisor retroclination and maxillary incisor proclination.[19] In the case presented the camouflage procedure by dentoalveolar compensation succeeded in enhancing the profile and occlusion of the patient.

The treatment process was completed within 17 months, including three months of the stabilization phase. A prior clinical trial showed that Damon (self-ligating bracket) performed 2.7 times faster alignment for moderate crowding than with the use of conventional brackets.[20] The PSL system reduces chair-side time and accelerates initial alignment.[21] Given the risk of recurrence, the stability of this skeletal Class III camouflage therapy should be evaluated. Essix retainers were used to maintain result stability because previous research indicated that Essix retainers are more successful than Hawley retainers in maintaining teeth alignment.[22]

## CONCLUSION

Camouflage treatment of an adult patient's skeletal Class III malocclusion resulted in attractive facial esthetics and dental occlusion. The PSL method addressed arch deficiency, mild-to-moderate crowding, midline shifting, and anterior crossbites in a very short period without the need for auxiliary appliances. The PSL system has the advantages of early torque control and various mechanisms that can be executed since the initiation of treatment. Further research is necessary to evaluate the treatment's efficacy, efficiency, and stability.

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### Statement of Authorship

Both authors participated in data collection and analysis and approved the final version submitted.

### Author Disclosure

Both authors declared no conflicts of interest.

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