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Beyond Sequential Treatment: Surgery-First Orthognathic Approach with Canine Substitution for Comprehensive Skeletal and Esthetic Resolution of Lateral Incisor Agenesis: A Case Report

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ABSTRACT

The surgery-first approach (SFA) to orthognathic treatment has emerged as a compelling alternative to conventional protocols, offering immediate skeletal correction without prolonged presurgical orthodontics. A key biological advantage is the regional acceleratory phenomenon (RAP), a post-surgical response that accelerates orthodontic tooth movement and reduces overall treatment duration significantly. The present case involved a patient presenting with a concave facial profile, retrusive upper lip, reverse overjet and overbite of 3 mm, proclined maxillary incisors, retroclined mandibular incisors as dental compensation, Class I molar relationship, maxillary arch spacing, mild mandibular anterior crowding, and congenitally absent maxillary lateral incisors. This constellation of findings, combined with the patient's desire for early esthetic improvement and the anticipated benefit of RAP-driven accelerated tooth movement, guided the decision toward SFA as the most appropriate patient-centred strategy. Le Fort I maxillary advancement was performed, followed by expedited postoperative orthodontics. Canine substitution addressed the congenitally missing lateral incisors and restored smile harmony. Treatment was completed in seven months, substantially shorter than conventional protocols. At the 24-month follow-up, Class I occlusion with ideal overjet and overbite was maintained, facial profile improvement remained stable, and functional outcomes were consistent.

Keywords: Canine substitution; Class III malocclusion; Maxillary retrognathism; Orthognathic surgery; Surgery-first approach.

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Introduction

Traditional orthognathic surgical interventions typically adhere to a sequential protocol requiring an extensive presurgical orthodontic phase—frequently spanning 12 to 18 months prior to definitive skeletal realignment; this methodology is often associated with a temporary exacerbation of the patient's dysmorphic facial features, reduced levels of patient compliance, and a comprehensive treatment timeline exceeding twenty-four months, factors which collectively influence many patients to postpone or ultimately decline therapeutic intervention. To mitigate these inherent limitations, the Surgery-First Orthognathic Approach (SFOA), as established by Nagasaka et al. [2], fundamentally reverses this treatment order by facilitating immediate skeletal correction at the inception of therapy, prior to any dental decompensation, thereby successfully circumventing the esthetically deleterious presurgical interval [1-3].

From a biological standpoint, SFOA strategically leverages the Regional Acceleratory Phenomenon (RAP), a transient postoperative elevation in bone remodeling dynamics evidenced by heightened serum biomarkers such as C-terminal telopeptide of type I collagen (ICTP) and alkaline phosphatase (ALP), which typically reach their peak within 3 to 4 months following the surgical procedure [1]. This specific osteogenic window facilitates accelerated tooth movement across all spatial dimensions during the initial 4 to 5 postoperative months, effectively compressing the total duration of treatment by an estimated 6 to 12 months when compared to traditional, orthodox protocols [1,3]. Gandedkar et al. defined the SFOA as a "one patient, two problem" clinical paradigm, which focuses on the sequential resolution of skeletal discrepancies followed by the management of dental malocclusions [3]. For the treatment of multifaceted skeletal malocclusions, SFOA has established itself as a biologically sound and patient-centred alternative. In complex cases further complicated by the congenital agenesis of maxillary lateral incisors, the implementation of canine substitution provides a financially viable and periodontally advantageous resolution characterized by a natural, long-term adaptation of the gingival tissues [4,5].

Case Presentation

A 20-year-old post-pubertal female presented for clinical evaluation with a primary chief complaint of generalized spacing within the maxillary anterior segment and an esthetically prominent mandibular positioning. The patient's medical and dental histories were non-contributory, and both the patient and her parents demonstrated high levels of motivation for a comprehensive orthodontic-surgical therapeutic intervention.

Clinical Examination

Extraoral and Functional Assessment

Clinical assessment in the frontal plane revealed a euryprosopic facial pattern characterized by marked bilateral symmetry, with no significant deviation of the mandible noted. Profile analysis demonstrated a concave pattern coupled with anterior facial divergence; additionally, the upper lip morphology appeared retrusive relative to the esthetic plane. Evaluation of stomatognathic function indicated a physiologic range of mandibular excursion. The temporomandibular joints were asymptomatic, showing no clinical evidence of clicking, crepitus, or discomfort, and palpation of the masticatory musculature elicited no tenderness. Centric relation and centric occlusion were found to be coincident, precluding any detectable functional shift.

Intraoral Examination

- Sagittal Dimension: Assessment identified a bilateral Class I molar relationship complicated by a 3 mm reverse overjet.
- Transverse Dimension: An anterior crossbite was present involving the maxillary incisors in the absence of a posterior crossbite. The maxillary dental arch presented with generalized spacing, while the mandibular arch exhibited mild anterior crowding.
- Vertical Dimension: A 3 mm reverse overbite was recorded in conjunction with a mild Curve of Spee(2 mm).

Soft Tissue and Smile Analysis

Soft tissue evaluation with the labial musculature in repose confirmed lip competence and the absence of perioral hypertonicity. Both the interlabial gap and resting maxillary incisor exposure measured 0 mm, with a discernible negative step evident. Static analysis confirmed an absence of incisor display at rest. Upon dynamic smiling, the most significant esthetic finding was pronounced spacing within the maxillary anterior segment resulting from lateral incisor agenesis. This spacing, when combined with the 3 mm reverse overjet and anterior crossbite, resulted in a flattened smile arc and diminished support for the upper lip.

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Model analysis

Bolton's tooth size analysis identified a significant maxillary tooth material deficiency, which was found to be directly attributable to the congenital agenesis of the maxillary lateral incisors.

Radiographic Examination

Panoramic imaging confirmed the absence of maxillary lateral incisors (12,22) and the presence of impacted mandibular third molars. Lateral cephalometric analysis established a skeletal Class III base with an average growth pattern, as evidenced by an FMA of 25°, a Bjork sum of 391°, and a Jarabak ratio of 65.2%. Pre-existing dentoalveolar compensations were characterized by proclined and protrusive maxillary incisors (U1-SN = 115°; U1-NA = 6 mm/40°) and retroclined, retrusive mandibular incisors (IMPA = 77°; L1-NB = 2.5 mm/13°). Soft tissue analysis further quantified upper lip retrusion relative to Steiner's S-line (–3 mm) and Ricketts' E-line (–7 mm). Following a comprehensive diagnostic synthesis, a final diagnosis of Angle's Class I, Dewey's Type 3 malocclusion was established, superimposed upon a skeletal Class III jaw base secondary to marked maxillary retrognathism. In prioritized response to the patient's primary esthetic concerns and the availability of a more expedited therapeutic paradigm, the Surgery-First Orthognathic Approach (SFOA) was adopted. This protocol was strategically selected for its capacity to facilitate immediate skeletal realignment, ensure early-phase facial profile enhancement, and significantly compress the comprehensive treatment timeline.

To systematically address the identified clinical problem list, the following therapeutic objectives were established:

1. Execution of a Le Fort I maxillary advancement to rectify the skeletal Class III discrepancy and augment midfacial esthetics.

2. Elimination of the reverse overjet and reverse overbite to re-establish a functional and physiologic anterior occlusal relationship.

3. Comprehensive alignment and leveling of both dental arches to resolve generalized maxillary spacing and localized mandibular anterior crowding.

4. Morphological recontouring and reshaping of the maxillary canines (13 and 23) to simulate lateral incisors, thereby providing a biological compensation for the congenitally absent maxillary lateral incisors.

5. Resolution of the anterior crossbite with a terminal objective of finishing in a bilateral Class II molar relationship to achieve a balanced, stable, and harmonious occlusal and facial outcome.

Treatment Plan

A conventional acrylic surgical splint was meticulously fabricated from articulated study models following a comprehensive pre-surgical mock simulation, which confirmed the requirement for a 6 mm maxillary advancement to achieve bilateral Class I molar and canine relationships. Twenty-four hours prior to the surgical intervention, fixed preadjusted edgewise appliances (MBT prescription, 0.022″ × 0.028″ slot) were bonded across both dental arches, and passive 0.019″ × 0.025″ stainless steel surgical archwires with integrated welded hooks were secured via steel ligatures to facilitate intraoperative stability. In the operating room, a Le Fort I osteotomy was executed to facilitate the planned 6 mm maxillary advancement. Rigid internal fixation was subsequently achieved using two L-shaped, four-hole titanium miniplates, each stabilized with four monocortical screws, positioned bilaterally at the paranasal and zygomatic buttresses. Following the removal of the temporary surgical splint, an elastomeric chain was applied over the soldered hooks to maintain intermaxillary fixation for a duration of two weeks, after which Class III elastics were introduced to guide functional occlusal settling.

Comprehensive orthodontic mechanics were reinstituted four weeks postoperatively, contingent upon the attainment of satisfactory mandibular range of motion. The leveling and alignment phase progressed through a standardized sequential wire series, during which residual spaces were consolidated, and the maxillary canines underwent morphological recontouring and reshaping to simulate the missing lateral incisors. Six weeks later, 0.019″ × 0.025″ TMA finishing archwires were utilized to refine torque and finalize the occlusion. The comprehensive active treatment phase was concluded seven months post-surgery, resulting in a marked enhancement of the facial profile, definitive resolution of the skeletal Class III discrepancy, and the establishment of a stable Class I occlusion characterized by ideal overjet and overbite. Longitudinal assessment through 24-month post-treatment records confirmed excellent clinical and radiographic stability of the achieved results.



Figure 1. Pretreatment facial and intra-oral photographs.

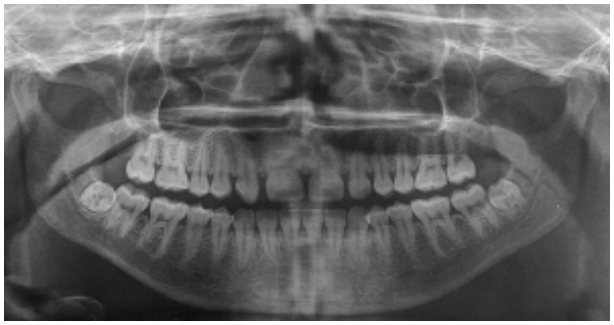


Figure 2. Initial panoramic radiograph.



Figure 3. Initial cephalogram.



Figure 4. Post surgical facial and intra-oral photographs.

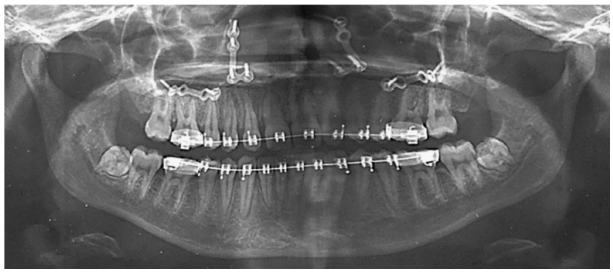


Figure 5. Post surgical panoramic radiograph.



Figure 6. Post surgical cephalogram.

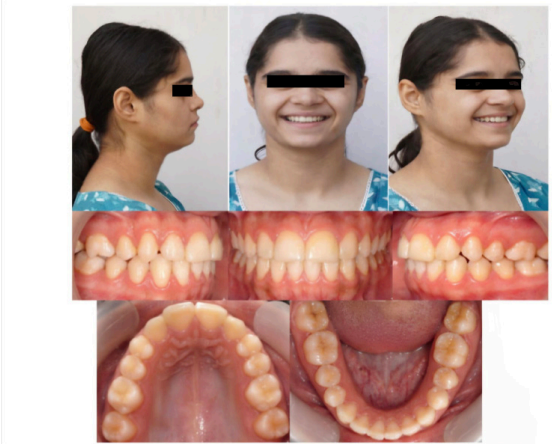


Figure 7. Final facial and intra-oral photographs.



Figure 8. Final panoramic radiograph.

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Figure 9. Final cephalogram.



Figure 10. 24 month follow up facial and intraoral photograph.

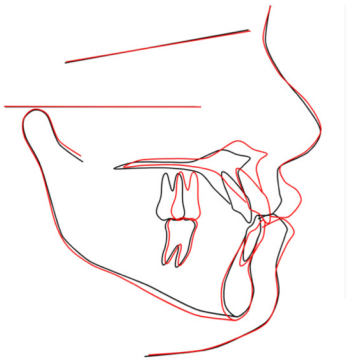


Figure 11. Superimpositions of initial (black) and final (red) cephalometric tracings.

Table 1. Cephalometric data.

	Measurement	*Norm*	*Pre-treatment*	*Post- surgical*	*Post-treatment*
Skeletal pattern	*SNA*	*82^0*	*77^0*	*84^0*	*84^0*
	SNB	*8^0*	*82^0*	*82^0*	*82^0*
	ANB	*2^0*	*-5^0*	*2^0*	*2^0*
	WITS	*1 ± 2mm*	*-4.5mm*	*2.5mm*	*2.5mm*
	Angle of Convexity	*0^0*	*-14^0*	*5^0*	*5^0*
	Facial Angle	*87^0*	*89^0*	*89^0*	*89^0*
	SN.GoGn	*32^0*	*29^0*	*30^0*	*30^0*
	FMA	*26^0*	*25^0*	*26^0*	*26^0*
Dental pattern	*IMPA*	*95^0*	*77^0*	*81^0*	*85^0*
	U1-NA (^{0})	*220*	*40^0*	*30^0*	*33^0*
	U1-NA (mm)	*4mm*	*6mm*	*4.5mm*	*6mm*
	L1.NB (^{0})	*25^0*	*16^0*	*16^0*	*20^0*
	L1-NB(mm)	*4mm*	*2.5mm*	*3mm*	*4mm*
	Interincisal angle	*130^0*	*132^0*	*130^0*	*127^0*
	U1-Palatal plane	*110^0*	*126^0*	*122^0*	*123^0*
	U1 - APg	*4mm*	*2.5mm*	*4mm*	*5mm*
Profile	*Upper lip to E plane*	*-4 mm*	*-7 mm*	*-2.5 mm*	*-2.5 mm*
	Lower lip to E plane	*-2 mm*	*-2 mm*	*0 mm*	*0 mm*

Discussion

The surgery-first orthognathic approach (SFOA) is characterized by the execution of orthognathic surgery in the complete absence of any presurgical orthodontic preparation, representing a fundamental departure from the sequencing employed in the conventional orthognathic surgery approach (COSA) [1]. This particular patient demonstrated a constellation of clinical features that collectively rendered her a strong candidate for SFOA: a mild Curve of Spee of 2 mm, negligible anterior crowding within the mandibular arch, and established dental compensations manifesting as proclined maxillary incisors (U1-SN 115°) and retroclined mandibular incisors (IMPA 77°) with minimal transverse discrepancies. that were well-suited to postsurgical correction [6,7].

The principal etiological basis of her dentofacial deformity was identified as maxillary retrognathism (SNA 77°, ANB –5°) in the context of a skeletally normal mandible (SNB 82°) and an average growth pattern, thereby establishing isolated Le Fort I advancement as the most clinically rational initial intervention. Given that a conventional surgical sequence would have necessitated 12–24 months of presurgical orthodontic treatment, a period known to progressively worsen facial concavity and undermine patient cooperation [2,3], SFOA was selected to afford immediate skeletal correction alongside early and tangible facial enhancement. This decision is corroborated by Bichu et al., whose findings demonstrated measurably superior oral health-related quality-of-life outcomes among SFOA patients relative to those managed through conventional protocols [1].

The biologic substrate of the Regional Acceleratory Phenomenon facilitated expedited postsurgical correction of the preexisting dental compensations within the 4–5-month osteogenic window, thereby compressing the total active treatment duration to seven months. This timeline stands notably shorter than the mean durations of 14.2 months for SFOA and 20.2 months for conventional approaches documented by Bichu et al. and Choi et al. [1,8], and is further consistent with the 15-month SFOA treatment timelines and stable outcomes reported by Bhattacharya et al. [6]. The question of long-term skeletal stability was addressed by Ko et al., whose data revealed no statistically significant divergence in relapse rates between the surgery-first cohort (14.3%) and the conventional cohort (15.7%) among Class III patients who underwent maxillary advancement [9]. By eliminating the need for pre-surgical orthodontic decompensation, the surgery-first approach allows patients to experience rapid gains in facial esthetics and functional occlusion, while overall treatment duration is generally condensed to 12–18 months, contributing positively to patient psychosocial well-being [10]. These findings were reinforced by 24-month clinical follow-up, which confirmed sustained skeletal, dental, and soft-tissue stability in this case. With respect to the bilaterally congenitally absent lateral incisors, canine substitution via morphological recontouring of teeth 13 and 23 was preferred over implant-supported prosthetic replacement, as Bolton analysis revealed a pronounced maxillary tooth material deficiency. Furthermore, the patient fulfilled Datta's favorable substitution criteria: a mildly convex profile anticipated following Le Fort I advancement, a post-adolescent adult dentition, and a treatment plan oriented toward a Class II molar finish [4].

Josefsson and Hedmo demonstrated that orthodontic space closure confers superior long-term periodontal outcomes, circumvents the progressive infra-occlusion and peri-implant osseous deterioration inherent to anterior maxillary implants, and represents the most cost-effective management strategy [5], directly resolving the patient's primary complaint of anterior spacing while negating the need to defer treatment pending alveolar maturation. The integration of SFOA with canine substitution proved particularly synergistic: SFOA established a corrected Class I skeletal foundation that streamlined the anteroposterior mechanics of canine substitution, ultimately yielding a harmonious smile arc, normalized overjet and overbite, and sustained patient satisfaction through 24-month follow-up.

This case was planned using two-dimensional lateral cephalometry and panoramic radiography rather than CBCT or virtual surgical planning, limiting assessment of transverse/vertical asymmetry, condylar positioning, and true three-dimensional surgical movement. CBCT was not obtained because the deformity was a symmetric, isolated sagittal discrepancy requiring only single-jaw Le Fort I advancement, for which conventional cephalometric planning was judged adequate while limiting radiation exposure and cost. CBCT and virtual surgical planning are recommended for future SFOA cases involving facial asymmetry or complex three-dimensional movement.

Conclusion

This case highlights the advantages of SFA in avoiding the esthetic deterioration associated with presurgical orthodontics, reducing overall treatment time,

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and enhancing patient satisfaction. Precise diagnostic assessment, individualized treatment planning, and seamless interdisciplinary collaboration were indispensable in achieving a stable functional occlusion, a balanced facial profile, and durable long-term treatment outcomes.

Conflict of Interest

There is no conflict of interest to declare.

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