CASE REPORT

# Nonextraction Management of Severe Crowding in a Growing Patient with Borderline Malocclusion: Case Report

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## Abstract

A borderline case presents with mild skeletal disharmony or orthodontic problems due to arch length discrepancy and migration of teeth or a combination of these but is masked by a balanced soft tissue relationship. This case report describes one such borderline case of a 13-year-old girl who complained of irregularly placed upper and lower front teeth. Extraoral examination revealed balanced soft tissue with a mild convex profile, competent lips, and an average nasolabial angle. Intraorally, she had mixed dentition with flush terminal in primary molars and a class I relation in the permanent molars, severe crowding in the lower anterior, and congenitally missing permanent right laterals. A nonextraction protocol was followed, harnessing the pubertal growth spurt to alleviate the crowding and thereby preserving the soft tissue harmony.

**Keywords:** Borderline, Case report, Crowding, Growing patient, Interceptive orthodontics, Nonextraction, Soft tissue harmony.

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## Introduction

Every malocclusion is a conundrum that entails analytical reasoning. Initially orthodontic diagnosis and treatment planning was principally based on the hard tissue relationship and Angle's "nature's intended ideal arch form." The dawn of the soft tissue paradigm revamped the whole philosophy of orthodontics.[1] Emphasis on the soft tissue harmony *de facto* leads to a quandary—to extract or not to extract. This question has baffled orthodontists for centuries. This decision-making becomes even more challenging when the patient has a hard tissue malocclusion concealed by good facial esthetics. In such cases, extraction of permanent teeth is required to reach a stable and functional occlusion, but that may alter the soft tissue profile.[2] A typical borderline case presents with mild skeletal disharmony or orthodontic problems due to arch length discrepancy and migration of teeth or a combination of these but masked by a balanced, soft tissue relationship. The lack of concrete guidelines in treating these cases imposes extra pressure on clinicians to arrive at a proper treatment plan. A priori of facial esthetics, tooth size arch length discrepancy (TSALD), growth trend, and anchorage requirements are essential before arriving at a decision.

In this context, this case report describes one such borderline case that was intervened during the mixed dentition stage and treated without extraction.

## Patient Information and Clinical Findings

A 13-year-old female patient sought orthodontic treatment with the chief complaint of irregularly placed lower front teeth. Medical, familial, and dental history was noncontributory. The patient had an apparently symmetrical face with competent lips and a flat smile arc on the frontal extraoral examination. On profile analysis, she had a mild convex profile with an average nasolabial angle and mentolabial sulcus. The oblique view revealed a social smile with upright upper incisors and normal cheekbone contour (Fig. 1). Intraoral examination and study casts showed mixed dentition with a flush terminal plane in the deciduous second molars, permanent first molars in class I relationship, deciduous upper canines, and a lateral incisor in the first quadrant. Reduced overjet and severe crowding of lower incisors were evident. Both the lower permanent canines were erupting buccally (Fig. 2). Pantomogram presented resorbing primary teeth and absence of maxillary right lateral incisor (Fig. 3). It was also seen that the maxillary right canine was just apical to the retained primary laterals and mesially inclined (Fig. 4). Lateral cephalogram confirmed class I skeletal base with ANB of 2° and cervical vertebral maturation index stage 3. A handwrist radiograph showed the patient was in a pubertal growth spurt (Fig. 5).

## Treatment Plan

The nonextraction protocol opted to maintain the balanced soft tissue profile. Therapeutic diagnosis and sequential assessment were done to review the progress.

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**Fig. 1:** Pretreatment extraoral photographs

**Fig. 2:** Pretreatment intraoral photographs

**Fig. 3:** Pretreatment orthopantomogram

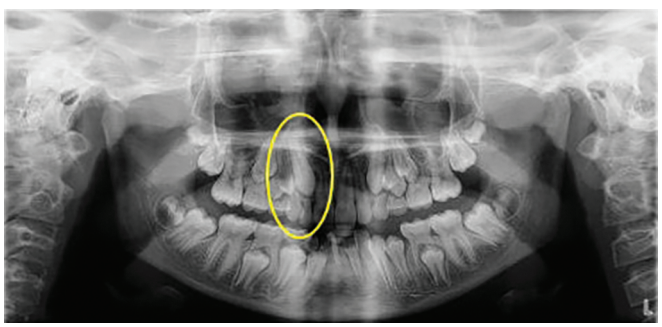

**Fig. 4:** Mesially positioned permanent canine

## Treatment Progress and Biomechanical Considerations

The treatment was commenced by banding the maxillary permanent first molars. A transpalatal arch (TPA) was given to augment the anchorage. This prevented the mesial migration and helped in maintaining the E space when the primary molars exfoliated. The upper centrals and left laterals were strapped up using MBT (0.022 × 0.028 inch) slot (3M Unitek, Monrovia, California) (Fig. 6). A lingual arch was given in the mandibular arch to reinforce anchorage and as a space maintainer. The lingual arch made active contact with the lower right laterals. This pushed the tooth labially and aided in decrowding (Fig. 7). As the teeth erupted, they were bonded (Fig. 8). After leveling and alignment, an open coil spring was inserted between the upper right bicuspids to create space for future replacement (Fig. 9). The archwires were progressed sequentially from 0.014 NiTi wire till 0.019 × 0.025 SS (Fig. 10). After 21 months of treatment, the fixed appliance was removed.

## Results

The intraoral photographs after the treatment illustrated a well-aligned lower and upper arch with ideal overjet and overbite. The upper right canine was substituted for lateral incisors. The upper first premolar substituted as canine was in class I in relation to the lower right canine. On the left side, the canines were in class I relation. The space between the first and second premolars in the first quadrant was maintained with a bonded retainer placed

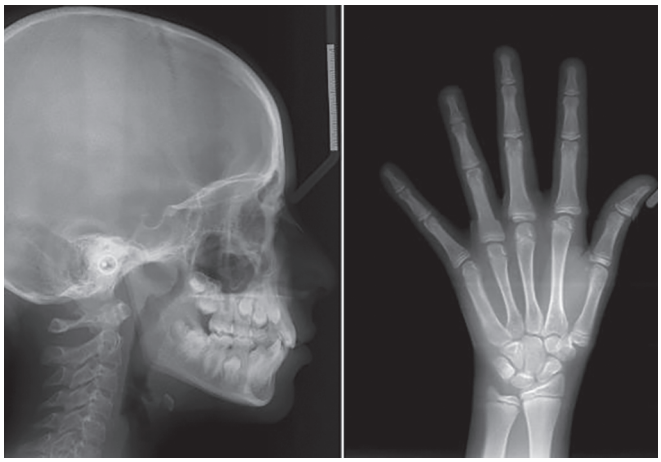

**Fig. 5:** Pretreatment lateral cephalogram and handwrist radiograph

**Fig. 7:** Lingual arch contacting anteriors

**Fig. 6:** Upper arch bonding and TPA

**Fig. 8:** Upper and lower arch bonded after eruption of permanent teeth

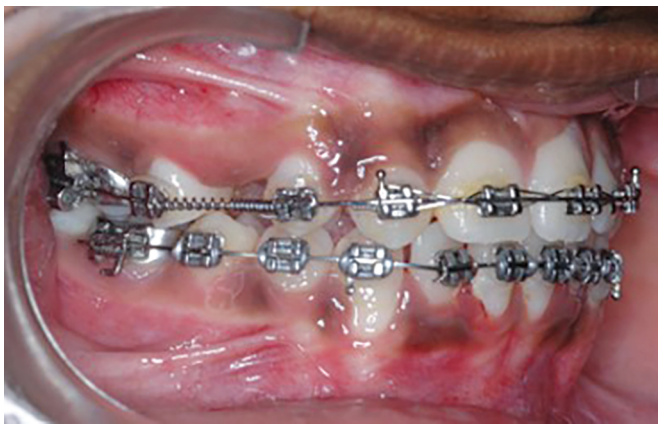

**Fig. 9:** Insertion of the open coil spring after leveling and alignment

palatally. The lower incisor alignment was retained with a lingual bonded retainer (Fig. 11). Posttreatment extraoral photographs and lateral cephalogram reveal ideal soft tissue and structural harmony, respectively (Figs 12 and 13). The edentulous space created for future replacement was temporarily restored with an acrylic tooth bonded to the upper Hawley's retainer (Fig. 14).

Thus, the decision to treat this case by not extracting the teeth helped achieve good occlusion and alignment without jeopardizing the profile and soft tissue cover, which was very evident in the posttreatment lateral cephalogram super imposition (Fig. 15).

## Discussion

In borderline cases, both extraction and nonextraction methods could validate the treatment options, which makes the decision-making process more complicated. Before arriving at a concrete

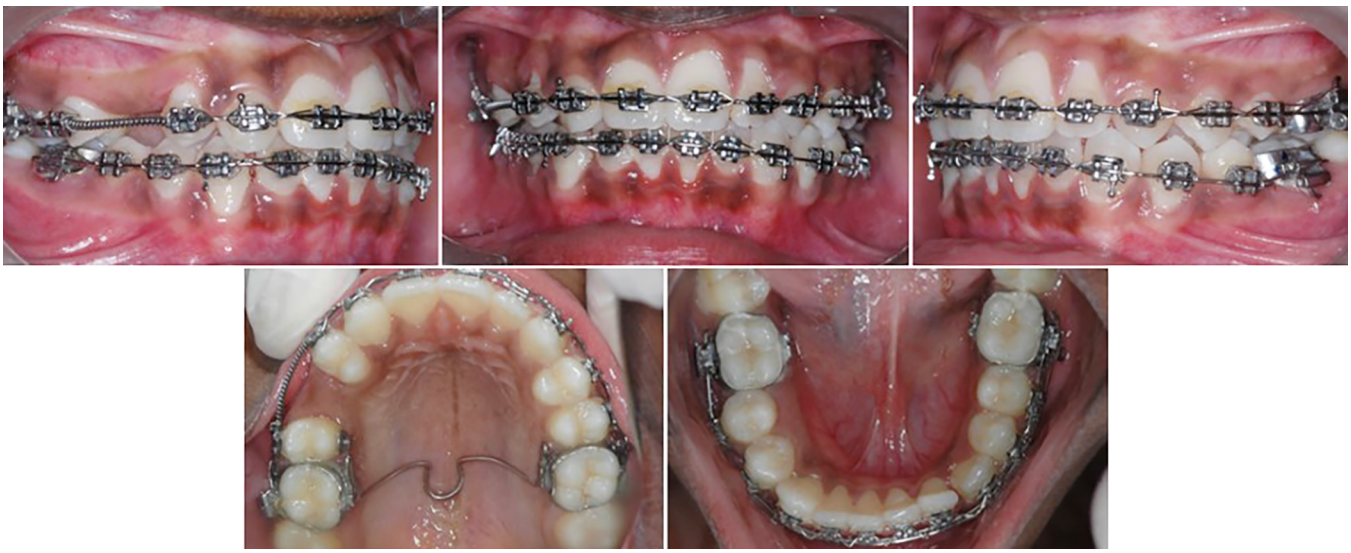

**Fig. 10:** Space created for future replacement

**Fig. 11:** Posttreatment intraoral photographs

**Fig. 12:** Posttreatment extraoral photographs

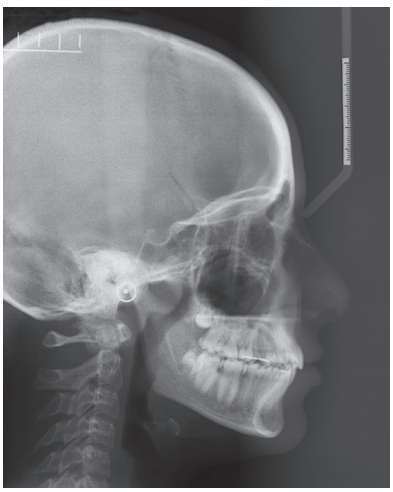

**Fig. 13:** Posttreatment lateral cephalography

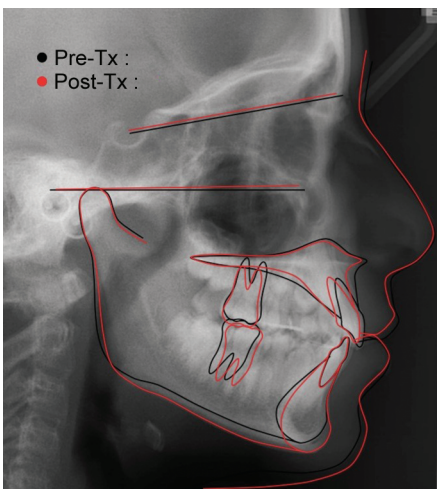


**Fig. 15:** Superimposition of pre- and postlateral cephalographs

**Fig. 14:** Hawley's retainer with acrylic tooth

decision, clinicians need to consider various factors that could contribute to borderline malocclusion. The dental variables that should be evaluated are TSALD, the curve of Spee, and Bolton discrepancy.

Tooth size arch length discrepancy is one of the main reasons for most malocclusions.[3] According to Carey's, TSALD for a borderline case should be 2.5–5 mm.[4] A discrepancy of 3–6 mm was set as arbitrary for borderline cases by McNamara.[5] Luppanapornlarp and Johnston stated that 1 mm of crowding in either arch could be managed without extraction, while 5.8 and 7.3 mm in maxillary and mandibular arches, respectively required extraction therapy.[6]

The 1 mm of the arch circumference is utilized for each millimeter of the curve of Spee depth.[7] Roth considered 3–6 mm of the curve of Spee mild (1.5–3.0 per side),[8] and Baldridge considered the curve to be severe if it exceeded 6 mm.[7]

Disproportionate individual tooth size causes tooth size discrepancy.[9]

According to Bolton, a discrepancy of >4 mm requires extraction.[10,11] Peck and Peck analysis states that borderline patients with small, narrow incisors may go for extraction.[12] A score of >6.5 mm would require extraction, according to the irregularity index.[13–15]

Skeletal variables for a borderline case must be elicited from cephalometric analysis. Sella-Nasion and mandibular planes angle[16] and Frankfort mandibular plane angle[17] are very important in determining extraction or nonextraction therapy. According to Tweed, the incisor mandibular plane angle value can range between 85 and 95°.[16] Values exceeding this range indicate extraction to improve functional and esthetic imbalance.

Balanced soft tissue is the ultimate goal of any orthodontic treatment. The question of extraction or nonextraction therapy should closely evaluate the pretreatment soft tissue profile and rule out any untoward consequence. Lip position and prominence and nasolabial angle are the key factors to be noted. The upper lip retracts 0.75 mm for each mm of upper incisor retraction, according to Ramos et al.[18] Talass et al. noted lower values for this ratio, which is 1/0.64.[19] The nasolabial angle is a very important determinant of extraction vs nonextraction debate. Extraction of four premolars increases the nasolabial angle by 5.2°, as found by Drobocky and Smith.[20] According to Arnett and Bergman, extraction is contraindicated in patients with flaccid lips due to the lack of labial support and the potential for esthetic concerns.[21] In this case, since nonextraction therapy opted, it was very important to maintain the E-space. "E" space or the difference between the mesiodistal (m-d) diameter of the second primary molar and the second premolar because the combined m-d diameter of the primary canine and first molar (13.64 mm) is approximately equal to the combined m-d diameter (13.85 mm).[22] E-space must be maintained in order to prevent mesial migration of permanent molars and can be utilized to decrowd the anteriors. Here, E-space was maintained using a lingual arch.

Singer[23] observed that both arch length and arch width were increased slightly by approximately 0.5 mm.

In cases of congenitally missing lateral incisors, the chances of canine impaction are 2.4 times higher.[24] In our case, in spite of congenitally missing laterals, the maxillary right canine erupted. This was because the maxillary right primary lateral incisor was retained beyond its exfoliation time (8–9 years), and the permanent canine was apical to the primary right lateral incisor.[25] This facilitated the mesial eruption of the right permanent canine, thereby making it ideal for substitution.

When the patient was apprised about the missing permanent tooth and the future need for replacement, she preferred to retain natural teeth in the anterior region. Studies have shown that the maxillary anterior alveolar ridge width reduces by 34% in 5 years.[26] This could even lead to the failure of implants in the anterior esthetic zone. The space that was maintained mesial to the second premolar could be used for future prosthetic replacement. The bone width in that area is ideal for an implant for which the patient was willing.

The nonextraction protocol proved to be successful mainly because the patient was in her pubertal growth spurt. Based on the concept of orthoeruption, orthodontic force applied to the erupting teeth, in this case, facilitated alveolar bone growth.

Thus, the arch form, size, and shape that was specific for this patient were restored.[27]

## Conclusion and Critical Appraisal

Meticulous treatment planning and therapeutic assessment are essential in treating borderline cases to maintain the integrity of facial structures and dentition.

In canine substitution cases, microesthetics need to be focused. Usually, brackets are flipped to achieve the same tip and torque of the lateral incisor. The tooth shade of canine is darker than the laterals and can be bleached to match the laterals.[28]

In our case, neither bracket modification nor bleaching was performed as the patient was still in the growth phase. The esthetic corrections were to be addressed after her growth completion.

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