

CASE REPORT

Correction of Anterior Crossbite and an Unesthetic Smile Arc in an Adult Patient

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Borderline and mild skeletal Class III relationships in adult patients are usually treated by orthodontic camouflage. Reasonably good results have been achieved with nonsurgical treatment of anterior crossbite, but the smile arc is more difficult to correct because proclination of the upper incisors results in further flattening of the arc. Since most of these patients already have a flat or reversed smile arc, the biomechanics used to procline the upper anterior teeth can actually worsen the smile.

A protraction utility archwire with slightly modified

mechanics, using reverse tipback bends and anterior torquing, can be used to correct a flat smile arc in a skeletal Class III case. Protraction and extrusion of the upper anterior teeth can be carried out simultaneously. This article describes such a case.

Diagnosis

A 20-year-old male reported to our orthodontic clinic complaining of restricted lateral movement of the lower jaw and an unesthetic smile (Fig. 1). He had experienced TMJ pain when chewing hard foods for about two months, and had noted an increase in lower anterior spacing over the previous two years.

Clinical examination revealed a mesencephalic head and mesoprosopic facial type, with a slightly concave profile and a low mandibular plane angle. The lips were competent, and the nasolabial angle was normal with no mentalis strain. The patient reported tenderness in the right TMJ on palpation and bilateral clicking in opening and closing. In smiling, he demonstrated inadequate incisor exposure, a reverse arc, and a complete absence of buccal corridors. The unesthetic

smile gave the patient an aged appearance.

Intraoral examination and study casts showed a Class I molar relationship on the right and an end-on relationship on the left. All permanent teeth were present except for the maxillary right and mandibular left third molars. The patient had a complete anterior crossbite extending from upper canine to upper canine, a reverse overjet of 2mm, and an overbite of 5mm. The upper and lower midlines were coincident with the facial midline. The upper arch was U-shaped, with rotations and minor crowding in the anterior region. The upper anterior teeth were retroclined, and wear facets from the anterior crossbite were apparent on the incisal edges. The lower arch was also U-shaped, with spacing from first molar to first molar. The pretreatment cephalogram indicated a mild Class III skeletal relationship (Table 1).

The anterior crossbite was ascribed to late exfoliation of the upper anterior teeth and palatal eruption of the upper permanent incisors and canines. The lower incisor spacing and TMJ pain could be attributed to traumatic occlusion.



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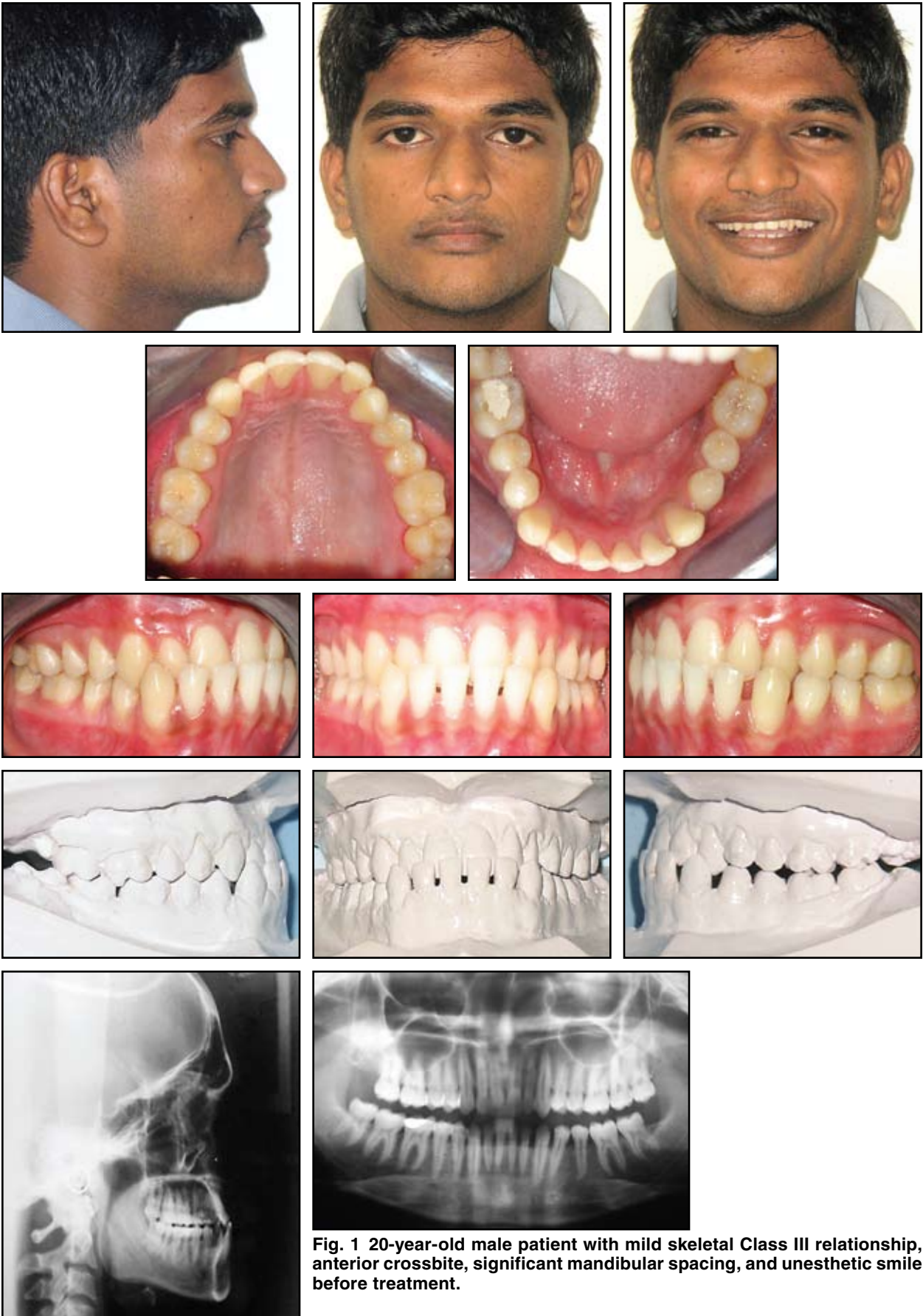


Fig. 1 20-year-old male patient with mild skeletal Class III relationship, anterior crossbite, significant mandibular spacing, and unesthetic smile before treatment.

**TABLE 1
CEPHALOMETRIC DATA**

	Normal	Pretreatment	Post-Treatment
SNA	82° ± 2°	82°	83°
SNB	80° ± 2°	83°	83°
ANB	2°	-1°	0°
FMA	25°	17°	17°
SN-GoGn	32°	18°	18°
Gonial angle	128°	114°	114°
IMPA	90°	95°	90°
Interincisal angle	130°	151°	130°
LAFH	67.2mm ± 4.7mm	63mm	63mm
U1-NA	22°	19°	27°
U1-NA	4mm	2mm	6mm
U1-APog	-1mm ± 5mm	1mm	5mm
L1-NB	25°	26°	23°
L1-NB	4mm	5mm	3mm
L1-APog	-1.2mm ± 1.4mm	3mm	1mm
E line-upper lip	-4mm	-8mm	-4mm
E line-lower lip	-2mm	-2mm	-2mm
Nasolabial angle	102° ± 8°	108°	94°
Overjet	2mm	-2mm	2mm
Overbite	2mm	5mm	2mm

Treatment Plan

Treatment goals were to:

- Achieve Class I canine and molar relationships with incisal guidance and a canine-guided occlusion.
- Relieve the traumatic occlusion by correcting the anterior crossbite.
- Align the arches and consoli-

date the spaces between the lower anterior teeth.

- Create a consonant smile arc and esthetic smile, establishing some negative space in the buccal corridors.

The major concern in this case was that the mechanics needed to correct the anterior crossbite and end-on relationships

would also tend to exacerbate the esthetic problems.

Treatment Progress

An .018" preadjusted appliance was bonded, with triple tubes on the upper molar bands and single tubes on the lower molars. A customized .036" stainless steel transpalatal arch was inserted between the first molars to control molar width and axial inclination in the frontal plane. A posterior bite block was built up with glass ionomer cement on the lower molars to relieve the occlusion. Sectional archwires were placed for leveling and alignment of the upper arch. Lingual buttons were bonded to the maxillary canines, with cross-elastics attached to correct the anterior crossbite. The upper posterior segments were stabilized with round stainless steel wires from the main tubes of the first molars to the canines.

With upper incisor intrusion contraindicated in this patient, a protraction utility arch¹ was fabricated from .017" × .025" titanium molybdenum wire and engaged in the upper anterior segment (Fig. 2). To facilitate slight extrusion of the upper incisors and correct the smile arc, we



Fig. 2 Upper incisor protraction using utility archwire.

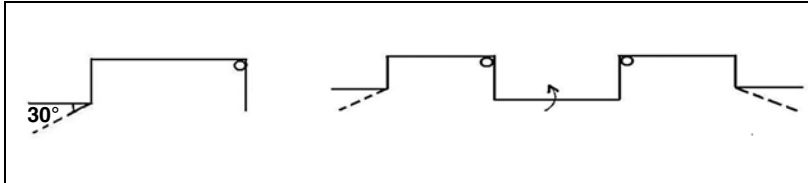


Fig. 3 Reverse tipback bend with labial crown torque added to anterior archwire segment.

added 30° reverse tipback bends on each side (Fig. 3). To counteract the lingual crown torque induced by this activation, we also added labial crown torque in the anterior segment of the archwire.

After four months of treatment with the protraction utility arch, the anterior crossbite had been corrected, and the posterior bite blocks were removed. The utility arch was left passively in place for an additional two months for stabilization. Finishing and detailing included the use of Class II elastics to achieve a Class I molar relationship on the left side. Appliances were removed after 18 months of treatment (Fig. 4A).

Although anterior crossbites typically do not require retention, the patient's upper anterior rotations and crowding and lower spacing indicated the need for a removable Hawley retainer in the upper arch and a bonded 4-4 lingual retainer in the lower.

Treatment Results

All the occlusal and esthetic goals were met. The upper incisor retroclination, anterior crossbite, and lower spacing were corrected. Well-aligned archforms and Class I canine and molar relationships were achieved, along with ideal

overjet (2mm) and overbite (2mm). A more favorable incisor-to-lip position was established at rest and during smiling, and the upper incisor extrusion achieved with the reverse tipback bends resulted in much better incisal display and a consonant smile arc, with negative space in the buccal corridors. The patient's self-confidence and self-esteem improved substantially.

A canine-guided occlusion with incisal guidance was achieved (Fig. 4B). Functional efficiency during chewing was markedly improved, and the TMJ pain was relieved with correction of the crossbite. At the end of treatment, the patient showed no clicking on opening and closing.

Cephalometric analysis indicated that the maxillary incisors were proclined to within the normal range (Fig. 4C, Table 1). SNA increased by 1° with the upper incisor protraction, indicating that bony remodeling at A point contributed to the improvement in the patient's profile. The mandibular incisors were uprighted, retracted, and slightly intruded, and an ideal lip position in relation to the E line was achieved. Marked improvement in the nasolabial angle and profile was noted after the establishment of ideal

overjet; the post-treatment interincisal angle was within the normal range.

Discussion

Malocclusions involving four or more teeth in anterior crossbite occur mostly in Class III cases, where the lower lip is often protruded relative to the upper lip.² Anterior crossbite should be corrected as early as possible, before eruption of the permanent canines,³⁻⁷ given that delay can result in the development of a full skeletal and dental Class III malocclusion, requiring surgical intervention at a later stage. While nonsurgical treatment of adult patients with this type of malocclusion is challenging, reasonably good results have been reported.^{2,8-14}

Our patient was unusual in presenting with a full anterior crossbite yet a mild Class III skeletal pattern ($ANB = 1^\circ$), involving a Class I molar relationship on one side and an end-on relationship on the other. It is rare to see an end-on molar relationship in a skeletal Class III case with a full complement of permanent teeth. Class III malocclusion and negative overjet predispose adults to mandibular dysfunction and to occlusal interference in a retruded mandibular position,¹⁵ which, in turn, can reduce functional efficiency during chewing. This was particularly true in our patient, who, before correction, had practically no lateral excursive movement of the mandible. The canine-guided occlusion with incisal guidance achieved with treatment

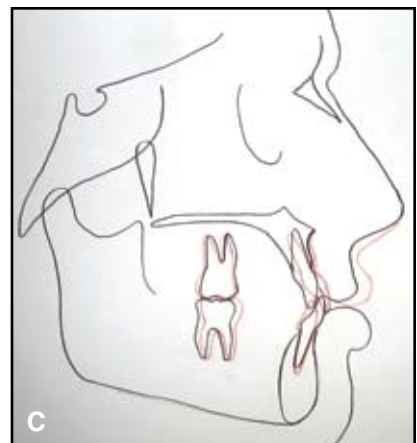
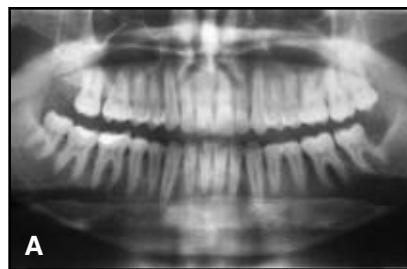


Fig. 4 A. Patient after 18 months of treatment. **B.** Canine-guided occlusion with incisal guidance. **C.** Superimposition of pre- and post-treatment cephalometric tracings.

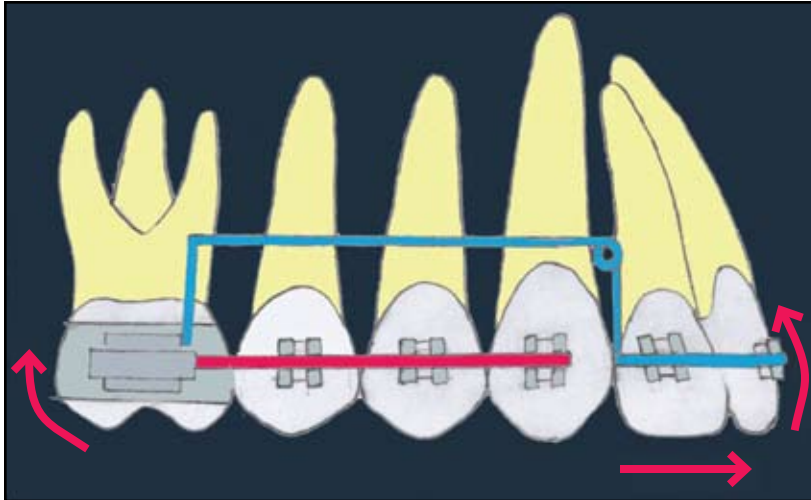


Fig. 5 Biomechanics in Class III case using standard protraction utility arch.

markedly improved his functional efficiency.

The transverse dimension of the smile is described in terms of its broadness and the amount of negative space.¹⁶ One characteristic of an unrealistic or contrived smile—a “denture smile”—is the lack of buccal corridors, which are established by the anteroposterior position of the maxilla relative to the lip drape.¹⁷ Our patient’s smile was corrected by using appropriately sized archwires to modify the upper archform.

Among skeletal Class III patients, who are likely to have a flat or reverse smile arc, the proclination of the upper incisors required for orthodontic camouflage will correct the reverse overjet at the expense of further flattening of the smile arc and reduction in the incisal exposure. On the other hand, slight extrusion of the upper incisors with proclination mechanics will

greatly enhance the smile. The protraction utility arch is useful for proclining and intruding both upper and lower incisors^{2,18-21} and correcting anterior crossbite.^{2,20,21} The long distance between the molar and the canine reduces the load-deflection rate, resulting in a favorable force and moment-to-force ratio.²²⁻²⁵ Furthermore, considering the large activations required, the utility arch is easily placed in the mouth.

Protraction utility archwires with tipback bends are commonly used in adult Class II, division 2 cases,^{18,19} especially those with impinging overbites, to procline and intrude the upper incisors. In Class III cases, they are used to protract the upper incisors and achieve a positive overjet. In either situation, the change in upper incisor position is accomplished through favorable, uncontrolled tipping.²⁶ The biomechanics employed in Class II, division

2 cases will also induce upper incisor intrusion, resulting in positive crown torque on the upper incisors and a clockwise rotation moment on the upper first molars. The biomechanics employed in Class III cases will produce protraction and flaring of the upper incisors, with positive crown torque on the upper incisors and a clockwise rotation moment on the upper first molars (Fig. 5). Unfortunately, these forces also tend to flatten the smile arc. In a patient with a reverse or flat smile arc, we recommend extruding the upper incisors during protraction by using 30° reverse tipback bends instead of the normal tipback bends in the protraction utility archwire. The reverse tipback bends will produce a counterclockwise rotation moment on the upper first molars (Fig. 6), which can be negated to some extent by placing a transpalatal arch between the upper first molars to control molar width and axial inclination in the frontal plane.

In the patient shown here, superimposition demonstrates the amount of upper incisor protraction and extrusion achieved by using the reverse tipback bends, as well as the positive effect of incorporating torque into the anterior segment of the archwire. Remodeling at A point contributed to a 1° improvement in ANB, which, in turn, helped achieve a better profile.

Further delay in treating this patient could have resulted in a host of issues, including mobility and possible loss of lower anterior teeth, further attritional

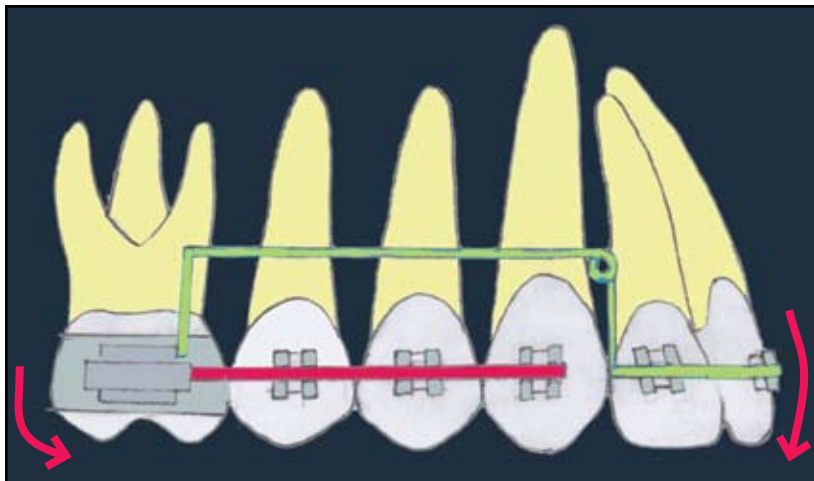


Fig. 6 Biomechanics using protraction utility arch with reverse tipback bends.

wear of the upper incisal edges, and damage to the TMJ from internal derangement and disc displacement. Apart from preventing these potential problems, we produced a good functional occlusion and an esthetically pleasing smile.

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