Introduction

Intrusion, as defined by Burstone, is the apical movement of the geometric center of the root with respect to the occlusal plane or to a plane based on the long axis of the tooth. Dental intrusion often constitutes an integral part of orthodontic treatment to improve sagittal and vertical incisor relationships to restore smile esthetics. The factors that lead to excessive gingival display on smiling include maxillary vertical excess, maxillary incisors supra eruption, and shortness of upper lip. For many years, intrusion of maxillary anterior teeth with fixed orthodontic appliance was considered impossible or problematic and was usually associated with numerous side effects to the periodontium or the dentition.

However, in recent years, by careful monitoring of the magnitude and direction of force, orthodontic intrusion can be considered a safe and proven procedure. Reverse curve Nitinol archwires, 3-piece intrusion arch, Connecticut intrusion arch, K-SIR arch, and Utility arches are conventionally used for incisor intrusion. The advent of skeletal anchorage has revolutionized the biomechanics of intrusion of maxillary anteriors. This case report details the clinical procedures done to achieve incisor intrusion with a midline mini-implant when used in conjunction with fixed appliance in a patient who required simultaneous intrusion and retraction.

Case Report

A 15-year-old postpubertal female reported with a chief complaint of reduced facial esthetics due to proclination of incisors and an associated gummy smile. Extraoral examination of the patient revealed a convex profile, incompetent lips, interlabial gap of 5 mm at rest, and gingival exposure of 4 mm during smile. Intraoral examination revealed Angle’s Class I malocclusion with proclined maxillary anteriors and deep bite (7 mm) [Figure 1].

Cephalometric examination revealed a skeletal Class I base with normal maxilla and mandible with a normodivergent growth pattern [Figure 2]. The profile was convex with a reduced nasolabial angle. Incisor exposure at rest was increased. The maxillary and mandibular incisors were proclined with respect to their corresponding bases. Based on the above evaluation, a problem list was charted, and treatment objectives were listed.

Problem list

1. Convex profile
2. Proclined maxillary and mandibular anterior teeth
3. Deep bite
4. Increased gingival exposure on smile.

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Aims and objectives of treatment
1. Improve the facial profile and maintain harmonious soft-tissue balance
2. Reduce the gingival exposure during smile
3. Correct maxillary and mandibular anterior inclination
4. Create an ideal overbite and overjet relationship
5. Close maxillary and mandibular arch spaces
6. Maintain Class I molar and canine relationship.

Treatment plan
1. Correct the convex profile by intrusion and retraction of the maxillary anterior teeth. This was favored by the decreased nasolabial angle at pretreatment. Extraction of four first premolars was required. An ORMCO Mini 2000 0.022” MBT (McLaughlin Bennett Trevisi) prescription Preadjusted Edgewise Appliance was bonded
2. Retract the maxillary and mandibular anteriors using the space gained by extraction of four first premolars
3. Simultaneous intrusion and retraction to be achieved with a midline mini implant (Absanchor, Dentos 1312 07) placed just beneath the ANS (Anterior Nasal Spine) [Figure 3]
4. Correct the deep bite by the intrusion of the maxillary anteriors and by correcting the inclination of the maxillary and mandibular anteriors with no adverse effects on the roots of the teeth or on the periodontium in the course of treatment.

Treatment progress
In the present case study, all four first premolars were extracted. Banding and bonding of both the arches were done with 0.022” × 0.028” MBT prescription (Mini 2000, Ormco, Glendora, CA, USA). Second molar banding was done to augment anchorage. Initial alignment and leveling was done with the wire sequence of 0.016” NiTi, 0.016” × 0.022” NiTi, and 0.019” × 0.025” NiTi archwires. The midline mini implant was placed in the midline of the anterior surface of the maxilla between and above the root tips of central incisors just beneath the ANS. This procedure was done under LA using a small vertical incision in the maxillary frenum. One week after suture removal, the screw was loaded with an active SS ligature tie. Space closure was done with 0.019” × 0.025” SS wire with posts for simultaneous en masse retraction along with intrusion [Figure 3]. Review appointments were given after every 4 weeks. After 18 months of total treatment time, debonding was done. Upper and lower Hawley’s retainers with a long labial bow were delivered to the patient. Tracings of pre- and post-treatment lateral cephalometric radiographs were made for different cephalometric parameters [Tables 1 and 2] to assess maxillary incisor intrusion and retraction [Figure 4].

Discussion
Correction of a deep bite in patients with an excessive gingival display and a normal lip length is one of the primary goals of orthodontic treatment, and maxillary incisor intrusion is the treatment of choice. Conventional intrusion mechanics may cause labial tipping of incisors, which does not always give favorable treatment outcomes. Studies have demonstrated that true intrusion can be achieved with mini implants.[4,5]

Post-treatment records [Figure 1] revealed that Angle’s Class I molar and canine relationships were maintained. Ideal overjet and overbite were achieved. Improvement was seen in profile, lip competency, interlabial gap at rest, and gingival exposure during smile. The amount of maxillary incisor intrusion achieved was 4.5 mm, which was evaluated with upper incisor to the palatal plane (PP) and the overbite was decreased by 2 mm. Creekmore and Eklund[6] in 1983, had demonstrated the use of miniscrews for intrusion of maxillary central incisors and obtained
marked intrusion of 6 mm. Ohnishi et al.\cite{7} in 2005 described a case of gummy smile correction with intrusion of the upper incisors by 3.5 mm using a mini-implant placed between the maxillary central incisors. There are numerous case reports and studies citing maxillary incisor intrusion using two mini-implants between the roots of lateral incisor and canine bilaterally for correction of gummy smile and they have obtained wide-ranging values for intrusion from 1.92 mm to 6 mm.\cite{4,8} If the patient required incisor intrusion along with retraction of incisors, placing two mini-implants between the roots of the lateral incisor and canine bilaterally for correction of gummy smile would be a disadvantage as the intrusion and retraction will have to be done in two stages—intrusion followed by retraction, to avoid contact with roots of incisors during retraction.

In the patient described in this case report, midline mini-implant with retraction using active tie-backs were used as she required simultaneous intrusion and retraction following extraction of first premolars for correction of gummy smile and proclination of anterior teeth. Placement of a single midline mini-implant just below the ANS was done to avoid the inadvertent risk of the implant coming in contact with the roots of lateral incisor or canine during retraction of maxillary anterior teeth. Furthermore, there was no labial flaring of maxillary anterior teeth during intrusion because of the simultaneous retraction force using active tie-backs.

Maxillary incisor retraction achieved in the patient was 5 mm as revealed by the upper incisor to vertical reference and pterygoid vertical. There was a significant reduction in the angular parameters of the upper central incisor during retraction also, as revealed by the values of Upper Incisor to SN and NA of 8.5° and 11° reduction in angulation, respectively.

In the present study, the maxillary first molar was evaluated both in the horizontal and vertical plane and revealed 1 mm downward and forward movement. Thus, the correction of the deep overbite occurred mainly due to the intrusion of maxillary anteriors and not due to extrusion of posteriors. Therefore, it can be interpreted that significant correction of the deep overbite was achieved with the application of intrusive forces using a single midline mini implant.

The cephalometric findings are tabulated in Table 3. The pre- and post-treatment changes obtained were significant at $P < 0.05$. Superimposition of pretreatment and post-treatment lateral cephalograms [Figure 2] also confirmed the clinical findings, along with improved esthetics. Periapical radiographs of the maxillary incisors pre- and post-treatment revealed minimal root resorption of Grade 1 according to the scoring system of Malmgren et al.\cite{9}

**Conclusion**

All the complex tooth movements involved in simultaneous intrusion and retraction of anteriors following extraction...
of four first premolars were achieved with a conservative approach and without any significant adverse effect on the teeth or the periodontium due to the area of placement of single midline implant being away from the roots of incisors unlike bilateral implants between the roots of lateral incisors and canines. The mid-line mini-implant can therefore be better for achieving significant maxillary incisor intrusion in patients with increased gingival display and proclination of anteriors who also require retraction simultaneously following extraction of premolars to correct proclination of anteriors. Care was taken to keep the forces light throughout the treatment to prevent any iatrogenic root injury during intrusion.

### Table 2: Description of Cephalometric parameters in the study

| Parameter | Description |
|-----------|-------------|
| SNA (°)   | Angle formed by joining the lines SN and N-A |
| SNB (°)   | Angle formed by joining the lines SN and N-B |
| ANB (°)   | Angle formed between lines NA and NB |
| GoGn-SN (°) | Angle formed by joining the mandibular plane to the anterior cranial base (SN plane) |
| UI-PtV (mm) | Horizontal distance from the incisal edge of upper incisor to PtV drawn perpendicular to PtV |
| UI-VR (mm) | Horizontal distance from the incisal edge of upper incisor to VR drawn perpendicular to VR |
| UI-PP (°) | Angle formed by intersection of PP and line passing through the long axis of upper incisor |
| UI-PV (mm) | Vertical distance from the incisal edge of upper incisor to PP drawn perpendicular to PP |
| UI-SN (°) | Angle formed by intersection of SN plane and line passing through the long axis of upper incisor |
| U1 to NA (°) | Indicates the relative angular relationship of the upper incisor teeth to the N-A line |
| U1 to NA (mm) | Indicates the relative forward or backward positioning of the incisor teeth to the N-A line |
| UI-LI (°) | Angle formed by passing a line through the incisal edge and the apex of the root of the maxillary and mandibular central incisors |
| U6-SN (°) | Angle formed by intersection of SN Plane and line passing through the mesial cusp and root of upper first molar |
| U6-VR (mm) | Horizontal distance from mesial cusp of upper first molar to VR drawn perpendicular to VR |
| U6-PtV (mm) | Horizontal distance from Pterygoid Vertical to mesial cusp of upper first molar |
| NLA (°) | Angle formed between lines NA and NB |
| PtV: Pterygoid vertical; VR: Vertical reference; PP: Palatal plane; Ls: Labrale superius; SN: Sella Nasion |

### Table 3: Pre- and post-treatment cephalometric values

| Parameter | T1   | T2   | Change |
|-----------|------|------|--------|
| SNA (°)   | 83   | 82   | 1      |
| SNB (°)   | 82   | 82   | 0      |
| ANB (°)   | 1    | 0    | 1      |
| GoGn-SN (°) | 26  | 27   | 1 increase |
| UI-PtV (mm) | 52  | 47   | 5      |
| UI-VR (mm) | 69  | 64   | 5      |
| UI-PP (°) | 130  | 121  | 9      |
| UI-PV (mm) | 23  | 18.5 | 4.5    |
| UI-SN (°) | 122.5 | 114  | 8.5    |
| U1 to NA (°) | 34  | 23   | 11     |
| U1 to NA (mm) | 8   | 5    | 3      |
| UI-LI (°) | 100  | 126  | 26 increase |
| U6-SN (°) | 79.5 | 82   | 2.5 increase |
| U6-VR (mm) | 35  | 36   | 1      |
| U6-PtV (mm) | 20  | 21   | 1      |
| NLA (°) | 85   | 96°  | 11 increase |
| Ls - E line (mm) | 0   | 2    | 2      |

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for images and other clinical information to be reported in the journal. The patient understands that names and initials will not be published and due efforts will be made to conceal their identity.

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### Conflicts of interest

There are no conflicts of interest.

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