Case Report

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Dentistry Section

Management of Bimaxillary Dentoalveolar Protrusion using the Snail Loop: A Case Report

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ABSTRACT

Bimaxillary protrusion is a prevalent malocclusion in the central Indian population, characterised by proclined upper and lower incisors, leading to lip incompetence and a convex profile. Management requires strategic treatment planning to achieve optimal functional aesthetic outcomes. The management of bimaxillary dentoalveolar protrusion presents a significant orthodontic challenge. The present case reports of a 17-year-old female patient with Angle's class I malocclusion, Dewey's type II modification, treated with the extraction of the first premolars in both the upper and lower arch, followed by en-masse anterior retraction using the Snail loop fabricated with 0.019"×0.025" titanium molybdenum alloy wire with preactivation alpha and beta bends of 20° and 30°, respectively. Complete space closure was achieved within six months with monthly activations, effectively demonstrating the efficiency of frictionless mechanics. Post treatment evaluation revealed significant improvement in incisor inclination {Upper Incisor to Nasion-A-Point (U1-NA) reduced from 29° to 23°, the Lower Incisor to Nasion-B Point angle (L1-NB) reduced from 36° to 27°}, enhanced facial profile (nasolabial angle improved from 93° to 108°) and achievement of lip competence (lower lip to E-line reduced from 2 mm to 0 mm). The present case demonstrates distinctive clinical significance through its achievement of en-mass anterior retraction utilising frictionless mechanics in a critical anchorage case, accomplished without skeletal anchorage while maintaining predictable force delivery, excellent torque control, and favourable dentoalveolar and soft-tissue results. Considering the limited clinical documentation available regarding the use of snail loop for bimaxillary dentoalveolar protrusion correction, the present case report represents a valuable addition to the clinical evidence base, substantiating the biomechanical efficacy and practical applicability of this technique.

Keywords: Anchorage control, Angle Class I, Malocclusion, Orthodontic Space closure, Tooth extraction

CASE REPORT

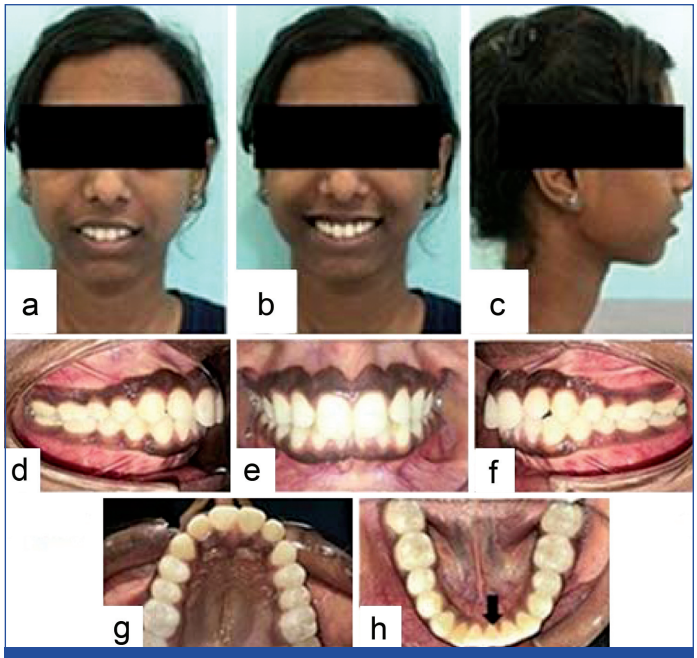
A 17-year-old female patient presented to the Department of Orthodontics with a chief complaint of forwardly placed upper front teeth. Written informed consent was obtained from the patient and her legal guardian prior to treatment initiation and for the publication of this case report, including clinical photographs and radiographs. Patient had no significant medical history with no systemic disease, allergies or medication. There was no history of trauma or previous orthodontic treatment. On extraoral examination, the patient presented with a convex profile, lip incompetence, and an acute nasolabial angle. The smile was consonant with 2 mm of gingival display on smiling. Intraoral examination revealed the molars and canines in class I with proclined upper and lower anteriors. Spacing was present in the upper anterior region, and mild crowding was seen with the lower anteriors. Overjet and overbite was increased [Table/Fig-1]. The patient denied any history of deleterious oral habits such as thumb sucking, tongue thrusting, or mouth breathing. No parafunctional habits were reported. Cephalometric analysis revealed that the patient has proclined upper incisors and lower incisors. (U1 to NA Angle, L1 to NB Angle) [Table/Fig-2,3]. Ashley Howe's index indicated a need for extraction.

Final diagnosis of Angle's class I malocclusion, Dewey's type II modification was made, necessitating the extraction of the first premolars in both the upper and lower arch, followed by space closure.

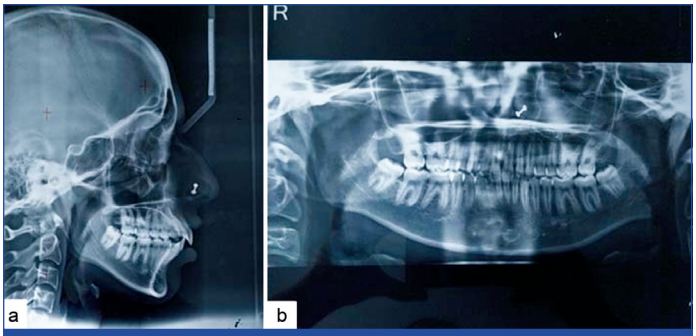
Treatment Objectives

- Achieve Class I canine and molar relationship bilaterally
- Reduce maxillary and mandibular incisor proclination to normal values
- Achieve lip competence and improve facial profile
- Correct increased overjet and overbite
- Establish functional occlusion with optimal intercuspation
- Improve smile aesthetics with appropriate gingival display

Treatment option consideration and rationale for selected method: After premolar extraction, orthodontic space closure may be accomplished through sliding mechanics, frictionless loop mechanics, or either approach augmented with skeletal anchorage. The present case employed frictionless mechanics with



[Table/Fig-1]: a-c) Pretreatment extraoral frontal, smiling, and profile photo; d-h) intraoral photos of maxillary and mandibular arch in occlusion.



[Table/Fig-2]: a) Pretreatment lateral cephalogram, demonstrating proclined incisors with increased overjet, and pretreatment orthopantomogram; b) orthopantomogram showing all permanent teeth present except third molars, with no pathology detected.

Parameters	Pretreatment	Post-treatment
SNA	84°	82°
SNB	79°	77°
ANB	5°	5°
FMPA	35°	36°
U1 to NA (Angle)	29°	23°
L1 to NB (Angle)	36°	27°
IMPA	105°	95°
Interincisal Angle	111°	105°
Nasolabial Angle	93°	108°
Lower Lip to E-line	2 mm	0mm

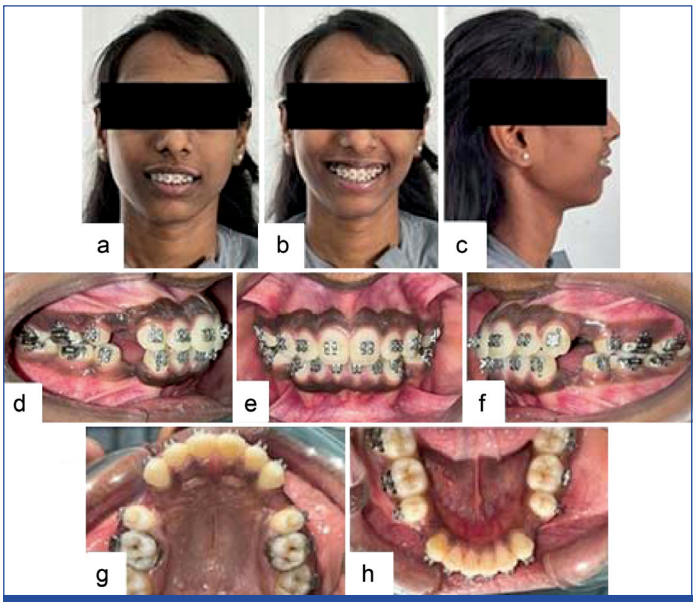
[Table/Fig-3]: Comparative cephalometric analysis showing pretreatment and post-treatment angular and linear measurements, demonstrating significant reduction in incisor proclination and improvement in soft-tissue profile parameters. SNA: Sella, nasion, and point A; SNB: Sella-nasion-B point; ANB: A-nasion-B angle; FMPA: Frankfort mandibular plane angle; IMPA: Incisor mandibular plane angle

a Snail loop, selected for its capacity to deliver a predictable and determinate force system with a clinically favourable moment-to-force ratio. This configuration permits controlled bodily translation of anterior teeth while significantly reducing frictional forces and minimising unwanted posterior anchorage loss. The clinical protocol deliberately excluded skeletal anchorage augmentation, as adequate anchorage preservation was reliably achievable through the synergistic application of loop mechanics in conjunction with methodical posterior segment consolidation, consequently obviating the requirement for an invasive auxiliary procedure and eliminating procedural complexity.

Treatment Progression

Written informed consent was obtained from the patient and her legal guardian after explaining the treatment plan, expected outcomes, duration, alternative treatment options, potential risks including root resorption and anchorage loss, and the need for retention. The patient and guardian were also informed about the photographic documentation for academic and publication purposes, and separate informed written consent for publication was obtained.

The treatment commenced with the bonding of a pre-adjusted edgewise appliance {MBT (McLaughlin, Bennett, and Trevisi) prescription, 0.022"×0.028" slot}. The maxillary and mandibular first premolars (14, 24, 34, 44) were extracted to facilitate the relief of crowding and retraction of anteriors. Initial leveling and aligning were initiated using 0.014" Nickel-Titanium (NiTi) archwires. This was sequentially followed by 0.016" NiTi, 0.016"×0.022" NiTi, and 0.017"×0.025" NiTi wires to achieve arch coordination and complete alignment. Following the initial alignment, rigid 0.019"×0.025" Stainless Steel (SS) base archwires were placed in both arches. On levelling and alignment, Deep bite correction was achieved through relative incisor intrusion and posterior extrusion. Mid-treatment examination revealed pit and fissure caries in the maxillary molars, which were subsequently treated with restorative intervention. During the caries excavation, it was seen that the caries in dentin were close to the pulp. Indirect pulp capping was planned. A mineralising calcium hydroxide cement was placed, followed by Glass ionomer cement and composite restoration prior to further orthodontic procedures. The areas visible in the post-treatment images correspond to the restored surfaces and represent unaffected, non active carious lesions rather than progressive carious lesion. Clinical evaluation at debonding confirmed the absence of active caries. Before starting the retraction, anchor preparation was done. Crowding was relieved, and space was closed [Table/Fig-4]. Before starting retraction, the posterior segments (second premolar to second molar) were consolidated to prepare the anchorage units.



[Table/Fig-4]: a-h) Mid treatment records after levelling and alignment.

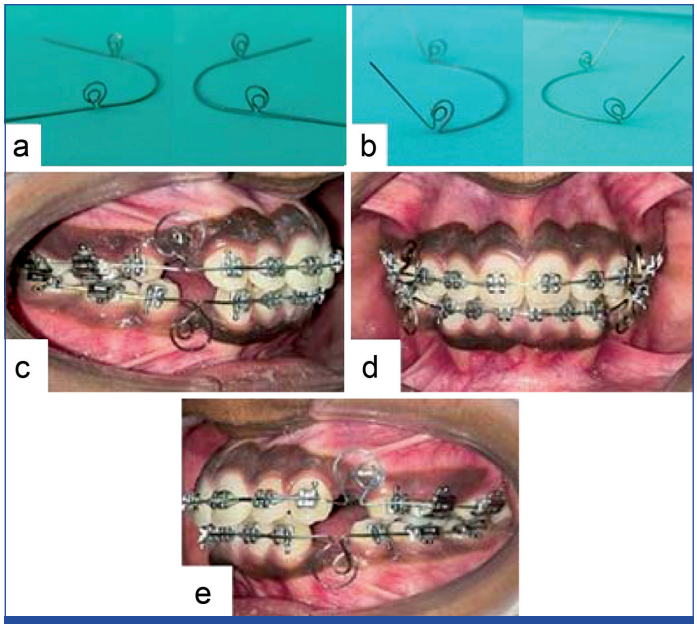
The Snail Loop was selected as the frictionless mechanic of choice for en masse anterior retraction.

The Snail loop was fabricated with 0.019"×0.025" TMA (Titanium Molybdenum Alloy) wire with a 2 mm activation. The Snail loop configuration had an outer loop with a height of 8 mm and a width of 6 mm, while the inner loop had a height of 6 mm and a width of 3 mm. Additionally, pre-activation alpha and beta bends of 20° and 30° were given, resulting in a combined angle of 50° [1,2]. Loop was activated monthly. Retraction and space closure was completed in six months. After space closure, finishing and detailing were carried out with 0.014-inch SS. After finishing and detailing, debonding was done [Table/Fig-5].

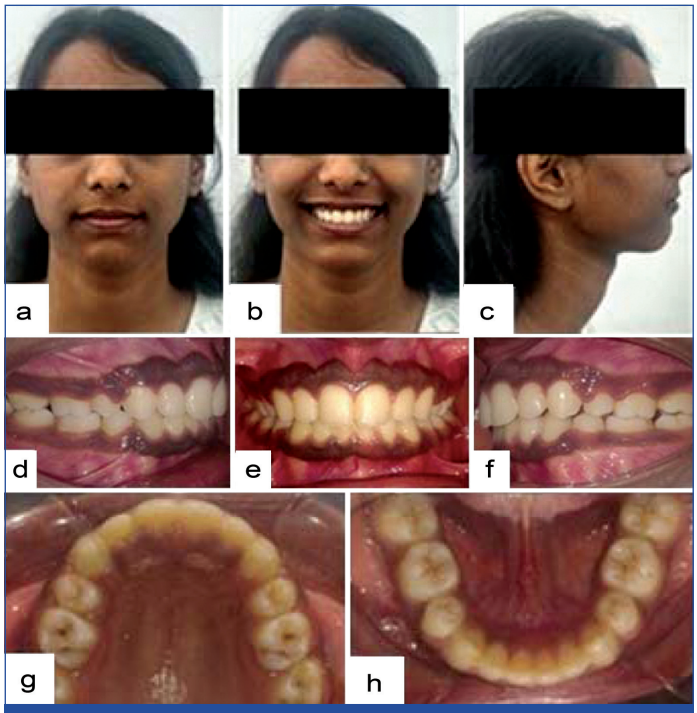
Treatment Outcomes

In the present case, complete space closure was achieved within six months using the Snail loop with monthly activations, demonstrating the efficiency of this frictionless mechanic. The post-treatment cephalometric analysis revealed significant improvements in incisor inclination (U1-NA reduced from 29° to 23°, L1-NB reduced from 36° to 27°), reduction in soft tissue convexity (nasolabial angle improved from 93° to 108°), and achievement of lip competence (lower lip to E-line reduced from 2 mm to 0 mm). These outcomes are consistent with reported success in managing bimaxillary protrusion through extraction-based orthodontic therapy.

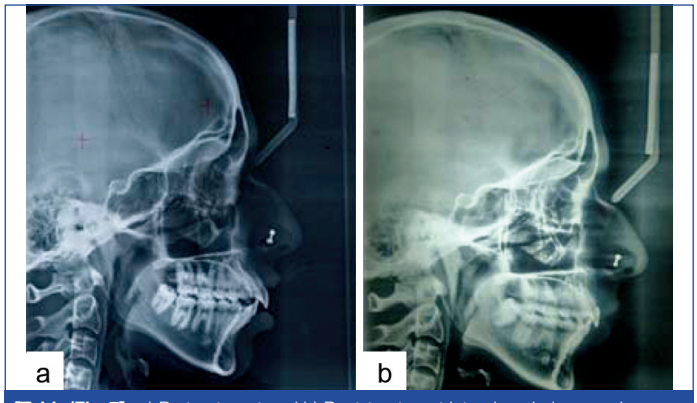
The slight decrease in SNA and decrease in SNB angles (SNA: 84° to 82°, SNB: 79° to 77°) reflects the dentoalveolar changes achieved through incisor retraction rather than skeletal modifications, which is expected in post-growth patients treated with orthodontics alone. The maintenance of ANB angle at 5° indicates that the sagittal skeletal relationship remained stable, with the primary changes occurring in the dentoalveolar region as intended [Table/Fig-6,7].



[Table/Fig-5]: Snail loop fabricated from 0.019"×0.025" TMA: a) Without pre-activation bend; b) With preactivation alpha bend (20°) and beta bend (30°); c) Intraoral photographs, right lateral view; d) Frontal view; e) Left lateral views.



[Table/Fig-6]: a-c) Post-treatment extraoral frontal, smiling and profile photo demonstrating improved facial profile, reduced convexity, achieved lip competence, consonant smile, and improved nasolabial angle; d-h) Intraoral photographs show with intraoral photos of maxillary and mandibular arch in occlusion with complete space closure, proper alignment, maintained Class I molar and canine relationships, ideal overjet and overbite, and well-aligned anteriors with improved inclination



[Table/Fig-7]: a) Pretreatment and b) Post-treatment lateral cephalogram demonstrating the extent of anterior retraction, uprighting of incisors, and improvement in soft tissue profile achieved through treatment.

All predefined treatment objectives were successfully achieved. Post-treatment records confirmed maintenance of bilateral Class I molar and canine relationships, normalisation of overjet and overbite, and establishment of functional occlusion. Cephalometric and soft-tissue parameters substantiated effective incisor retraction with improved lip competence and facial profile. Collectively, the clinical and radiographic findings validate comprehensive attainment of the planned treatment goals.

Fixed lingual retainers were bonded from canine to canine in both arches and removable Essix retainers were fabricated and delivered for nighttime wear to ensure long term stability. The patient was reviewed at 3-month intervals during first year post-treatment. At 12 month follow-up, the treatment results remained stable with no significant relapse in incisor position and profile change.

DISCUSSION

Bimaxillary protrusion is one of the prevalent malocclusions in the central Indian population, which is characterised by proclined upper and lower incisors, leading to lip incompetence [3]. The primary treatment objective for these patients is correction of the convex profile and incisor inclination through the extraction of the four first premolars [4].

The extraction of all four first premolars remains the gold standard approach for managing moderate to severe bimaxillary protrusion in orthodontic practice. This treatment strategy facilitates maximum retraction of anterior teeth, allowing for significant improvement in both dental and soft-tissue profiles. This approach effectively reduces soft-tissue procumbency and convexity of the facial profile by retraction and retroclination of the maxillary and mandibular incisors. The present case utilised a conventional four-first premolar extraction protocol, which provided adequate space (approximately 7-8 mm per side) for comprehensive anterior retraction while maintaining the Class I molar relationship.

Management of bimaxillary dentoalveolar protrusion presents a significant orthodontic challenge because of the critical anchorage demands associated with en-masse anterior retraction. Recent clinical evidence indicates that frictionless mechanics offer superior biomechanical efficiency compared with conventional sliding mechanics. Sardana et al., reported significantly reduced molar anchorage loss and improved control of anterior tooth movement with frictionless mechanics in a randomised clinical trial, underscoring their advantage in maximum anchorage cases [5]. Similarly, Attia AM et al., demonstrated that frictionless systems achieved space-closure rates comparable to friction-based mechanics while providing enhanced posterior tooth control when adequate anchorage reinforcement was incorporated [6]. Furthermore, Magdi S et al., observed a significantly faster rate of anterior retraction with loop-based frictionless mechanics, underscoring their greater efficiency and predictability [7]. These clinical findings are corroborated by biomechanical analyses showing that frictionless systems generate determinate force systems with optimal moment-to-force ratios and superior torque control [8]. Collectively, these studies justify the preference for frictionless mechanics in extraction cases with critical anchorage requirements, such as bimaxillary dentoalveolar protrusion.

The Snail loop, introduced by Vibhute PJ et al., is a closing loop designed for en-masse anterior space closure and is characterised by increased wire length and a low load-deflection rate, enabling sustained and controlled force delivery [1]. Rao PR et al., demonstrated through finite element analysis that Snail loops fabricated from 0.017"×0.025" and 0.019"×0.025" TMA wire with appropriate gable bends produce an optimal moment-to-force ratio conducive to bodily tooth movement while minimising uncontrolled tipping [2]. These biomechanical characteristics explain the predictable anterior retraction and effective torque control achieved in the present case. Jadhav VV et al., further supported these

findings, reporting that frictionless loop mechanics can achieve a moment-to-force ratio close to the ideal 10:1 required for translatory tooth movement while limiting anchorage loss when appropriate preactivation bends are incorporated [9]. In addition, Singhal C et al., demonstrated superior anterior tooth control and reduced tipping with loop-based mechanics compared with sliding mechanics, even in protocols supplemented with skeletal anchorage, emphasising the inherent biomechanical advantages of loop systems [10].

With respect to soft-tissue outcomes, Leonardi R et al., systematically reviewed nongrowing patients with bimaxillary protrusion and reported that four-premolar extraction consistently resulted in significant lip retraction and improvement in the nasolabial angle without excessive facial concavity [11]. These observations closely correspond with the improvements in lip competence and facial profile achieved in the present case.

Beyond biomechanical efficiency, the Snail loop offers clinical advantages, including reduced soft-tissue irritation, improved oral hygiene maintenance, and longer activation intervals due to its low load-deflection rate, thereby enhancing patient comfort and compliance. When fabricated with precision and combined with thorough posterior anchorage preparation, Snail loop-based frictionless mechanics provide a reliable, non-invasive alternative to skeletal anchorage for space closure in bimaxillary protrusion cases, delivering controlled anterior retraction while minimising undesirable anchorage loss associated with friction.

Future research should include controlled clinical trials and long-term follow-up studies to validate the effectiveness and stability of Snail loop-based frictionless mechanics. Further investigations using finite element analysis may help optimise loop design and pre-activation parameters, while standardised fabrication protocols could improve treatment predictability. Additional studies should also evaluate the applicability of this technique in complex clinical situations such as severe protrusion, asymmetric extraction patterns, and adult patients with compromised bone support

Patient's perspective: Patient satisfaction was high, particularly concerning aesthetic improvements to facial profile and smile. Minor post-activation discomfort resolved within 1-2 days. The patient regarded extended activation intervals as advantageous due to reduced clinic visit frequency.

CONCLUSION(S)

The present case report contributes valuable clinical evidence to the limited literature on Snail loop-based retraction for bimaxillary dentoalveolar protrusion. The rapid space closure and superior aesthetic outcomes achieved highlight the clinical viability of frictionless mechanics. The principal takeaway is that Snail loops represent an effective, non-surgical alternative for anchorage control when proper biomechanical principles and case selection criteria are applied.

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