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Advancements in Class-I Bimaxillary Protrusion Treatment: En-Masse Distalization with Damon® System and Intraoral Temporary Anchorage Devices: A Case Report

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Case Report

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Abstract

Background

Bimaxillary protrusion is characterised by proclined and protrusive maxillary and mandibular incisors with an accompanying convex soft-tissue profile, and has conventionally been managed by extraction of all four first premolars followed by anterior retraction. Extra-alveolar temporary anchorage devices, used together with a passive self-ligating bracket system, now permit en-masse distalization of both arches and thereby offer a non-extraction alternative in borderline cases. This case report describes such an approach and its dentoskeletal and soft-tissue outcomes.

Case presentation:

The case study deals with a 25-year-old man patient who showed skeletal Class II malocclusion, exhibiting Angle's Class I molar relationship bilaterally. The patient's diagnostic evaluation was consistent with a hypodivergent face pattern exemplified by maxillary and mandibular front teeth that were proclined forwardly and protruded, convex profile, lips possibly competent, nasolabial angle acute and posterior facial divergence. This therapy involved the use of intraoral Temporary Anchorage Devices (TADs) together with the Damon System to achieve mass distalization goals. The alterations in the face that resulted from this treatment strategy followed the expected skeletal and dentoalveolar changes which were aimed at for effective management of the case. Active treatment was completed in 18 months, of which 8 months were required for en-masse distalization of both arches.

Conclusions

The most cohesive environment giving rise to efficient arches distally is produced by the Damon System. En masse, distalization is better than premolar extraction or incisor retraction in borderline bimaxillary protrusion cases with good profiles. Therefore, it supports its usage in such clinical conditions.

INTRODUCTION

Class I malocclusion with bimaxillary protrusion is an unusual deviation in the field of orthodontics, wherein the front teeth of the upper and lower arches are visible outside their normal position. Appearance and function can be compromised by this condition. Traditional methods usually involve removing some teeth first and then moving the front ones into place so that they can help improve one's smile. However, this method in particular poses risks of having invasiveness-related issues as well as consuming most of a person's time making its use to have negative effects on their cosmetic appeal as well as structural integrity [1].

The Damon System is an appliance type without elastic bands that has been shown to reduce treatment time and pain while still allowing for proper influence over tooth movements. With Temporary Anchorage Devices (TADs), it is also possible to make precise tooth movements using stable anchor points which ensure no undesired outcome during correction if any occurs at all.

Mini-implants, also called miniscrews, are used as elements of a comprehensive suspension system in orthodontic treatment. However, there have been suggestions for extra-alveolar placements [2]. These alternative sites can endure the required force for distalization without causing any disruption or unwanted movements of the teeth. A more passive form of the selfy system exhibits reduced resistance in comparison to other bracket systems. This favorable attribute, when utilized in conjunction with Temporary Anchorage Devices (TADs), proves to be greatly advantageous for the en-mass distalization process [3, 4].

The conversion from dental extraction to non-exodontia treatment, employing mini-screws that help to completely distalize both maxillary as well as lower dentition, is addressed in this particular case report. This case reveals bimaxillary protrusion with a delicate soft tissue profile treated through distal movement of the whole upper and lower dental arches utilizing the Damon system with the use of Buccal Shelf Screws (BSS) and Infrazygomatic crest screws (IZC) without extracting premolars [4].

CASE PRESENTATION

Patient information and clinical findings

“A 25-year-old male patient presented with concerns regarding the forwardly placed front teeth, expressing a desire to have them corrected.” Following a thorough clinical evaluation, it was noted that the patient had previously undergone a cesarean birth. External examination findings included a leptoprosopic facial form, a dolichocephalic head form, lips displaying prospective competence, and a smile that exposed 80% of the incisors. Additionally, the patient exhibited a convex facial profile, a posteriorly divergent facial profile, a pointed nose tip, an acute nasolabial angle, an average cheekbone and malar prominence, and a retruded chin [Figure 1].

The patient was systemically healthy, gave no history of any medication, allergy, parafunctional habit, temporomandibular joint symptom or previous orthodontic treatment, and reported no relevant family or psychosocial history.

An intraoral examination revealed protrusion of the maxillary and mandibular anterior teeth, along with Angle's Class I molar relationship on both sides, having 3 mm overjet, 1 mm overbite, rotated and buccally placed upper right first premolar with ovoid shaped maxilla and mandible [Figure 2].

Diagnostic assessment

After evaluating the patient using radiography, it was found that the panoramic radiograph showed a normal temporomandibular joint (TMJ) with symmetrical condyles on both sides, and all third molars had erupted in each quadrant. The lateral cephalometric analysis revealed a skeletal Class II pattern (ANB angle = 4 degrees, mandibular angle = 27 degrees). Furthermore, the examination indicated that the upper and lower incisors were protruded (U1-SN = 129 degrees; IMPA = 105 degrees), and an increased interincisal angle of 95 degrees suggested bimaxillary protrusion and a low mandibular plane angle and reduced lower anterior facial height [Figure 3, 4].

A diagnosis of Angle's Class I molar relationship on a skeletal Class II base with bimaxillary dentoalveolar protrusion, a hypodivergent growth pattern and a convex soft-tissue profile was therefore established. Extraction of all four first premolars with anterior retraction was considered as an alternative treatment option, but was not selected because the arch-length discrepancy was minimal and premolar extraction carried a risk of over-retraction and flattening of an otherwise acceptable profile. No diagnostic difficulties were encountered, and the prognosis was judged to be favourable.

Timeline

The chronology of this episode of care is summarised in Table 1.

Table 1
Timeline of the episode of care.

Time point	Events
Month 0	Initial presentation with the chief complaint of forwardly placed anterior teeth; clinical examination, extraoral and intraoral photographs, study models, panoramic radiograph and lateral cephalogram obtained (Figs. 1–4); diagnosis and non-extraction treatment plan discussed and accepted; written informed consent obtained.
Month 0	Bonding of Damon® passive self-ligating brackets — low-torque brackets in the maxillary anterior segment and standard-torque brackets in the mandibular anterior segment.
Months 0–≈5 (levelling and alignment)	Sequential archwires: 0.014" CuNiTi, 0.014 × 0.025" CuNiTi and 0.018 × 0.025" CuNiTi.
After levelling and alignment	Placement of 2 × 12 mm stainless steel buccal shelf screws between the mandibular first and second molars and extended-collar stainless steel infrazygomatic crest screws between the maxillary first and second molars; engagement of 0.019 × 0.025" stainless steel archwires; panoramic radiograph and lateral cephalogram taken to confirm screw position (Figs. 5, 6).
Next 8 months	En-masse distalization of both arches using 250 g of force per side delivered from each bone screw to the contralateral screw, with force evenly distributed across all four quadrants.
Month 18	Completion of active treatment and debonding; post-treatment extraoral and intraoral photographs and radiographs obtained (Figs. 7, 8); retention commenced.
Follow-up	Occlusion, overjet, overbite and soft-tissue profile stable; the patient reported satisfaction with the dental and facial appearance and no adverse events were recorded.

Therapeutic intervention

Damon® system SLB brackets were used. The initial leveling and alignment process involved the use of 0.014" CuNiTi, 0.014 × 0.025" CuNiTi, and 0.018 × 0.025" CuNiTi archwires. The utilization of these archwires led to a significant improvement in patient comfort levels. It was decided to use brackets with low torque in the maxillary front teeth to address proclination, while brackets with ideal usual torque were used in the lower front teeth to hold the roots of the mandibular four anteriors in the cancellous bone between two cortical plates.

After the initial preparatory phase, we utilized additional-root IZC and BSS to effectively move both dental arches backward without causing any harm to the tooth roots. Stainless steel archwires measuring 0.019 × 0.025" were employed for the distalization process in both dental arches. To allow both dental arches to fully move backward without obstructing the tooth roots, we used stainless steel screws measuring 2 × 12 in the buccal shelf area between the first and second mandibular molars and SS IZC

screws with an extended collar in the infra zygomatic crest area between the first and second upper molars [Figure 5].

An OPG and a Lateral Cephalogram were performed to confirm the bone screws' placement. Retraction mechanisms were used, making sure the force was distributed uniformly throughout all quadrants, by delivering 250g of force via the connection of power cables from one screw to the opposite side screw. The entire backward movement of both dental arches was successfully achieved within 8 months, completing the entire treatment within 18 months [Figure 6].

Follow-up and outcomes

Post-treatment records confirm the accomplishment of treatment goals. The rearward migration of the front teeth is attributed with the notable changes in lip form and facial attractiveness shown in post-treatment photos. The molars and canines were successfully brought into a Class I relationship, and the overjet and overbite were optimal [Figure 7,8].

The cephalometric overlay showed that the lower incisors had receded by 5 mm and the upper molars by 6 mm, with the upper molars moving backward by around 5 mm at the top and 4 mm at the bottom. Two millimeters were pushed back on the upper lip and three millimeters on the lower lip, both of which were within the usual range of the E-line. The bimaxillary protrusion and profile was corrected, achieving proper angles of the nose-lip, lip-chin groove, and joint.

Treatment was well tolerated and the patient remained fully compliant throughout. No adverse or unanticipated events occurred: all four bone screws remained stable until planned removal, and there was no screw loosening, peri-implant inflammation, root contact, clinically detectable root resorption, periodontal breakdown or temporomandibular joint dysfunction.

Patient perspective

“I had always been conscious of my forwardly placed front teeth and of the fullness of my lips, and I avoided smiling in photographs. My main worry was that treatment would mean having healthy teeth taken out, so I was relieved when it was explained that the correction could be achieved without any extractions. The braces and the small screws were more comfortable than I had expected and did not interfere with my daily routine. At the end of treatment I was very happy with the way my teeth and my profile look, and I now smile with much more confidence.”

DISCUSSION

The alterations in the facial features resulting from the treatment were directly associated with changes in the skeletal and dental structures that were planned as per the concerns of the patient. The main incentive for pursuing orthodontic rehabilitation was to enhance facial aesthetics.

In cases of bimaxillary protrusion, where the upper and lower four front teeth severely protrude, orthodontic treatment can correct. Treatment often involves extracting all first bicuspids to create space for moving the front teeth back. Because the space required to move the front teeth back is less than the space required for extraction, patients with mild-to-moderate bimaxillary protrusion and a pleasing profile-where the soft tissue suggests a slightly convex to straight profile-frequently wonder if first premolar extraction is necessary during orthodontic treatment [5]. Other than third molars, these individuals usually opt not to have good teeth extracted. Four premolar extractions may be explored in situations when patients require significant changes in the placement of their incisors and the soft tissue profile. This kind of dental movement was accomplished using headgear, modified Nance arches, and pendulum appliances prior to the adoption of mini-implants for skeletal fixation. These conventional equipment struggled with patient compliance and had control limits.

Mini-implant anchoring provides more control over anchorage and less anchorage loss as compared to conventional distalizers. The exact placement of mini-implants is crucial when distalizing dental arches. Anatomical locations with a thicker cortical bone layer include the buccal shelf area, retromolar region, and infra zygomatic crest region. It is advised to position screws far enough away from the teeth's roots to reduce interference with dental motions [5, 6].

In the current scenario, employing the passive SLB in conjunction with bone screws in the infra zygomatic and buccal shelf areas has created an environment with less resistance for full-arch distal movement. As a result, the force exerted is efficiently conveyed to the teeth and their surrounding tissues without obstruction. The use of brackets with low torque in the maxillary anterior region has proven advantageous for correcting proclination, while brackets with standard torque in the mandibular anterior area facilitate positioning the roots in the cancellous bone for increased stability [7]. The exact location of the center of resistance (Cres) in the upper jaw is specifically at the midpoint of the roots of premolar teeth. when mini-screws are placed strategically with respect to Cres, it enables orthodontists to control the force vector’s magnitude and direction precisely thus facilitating targeted manipulation of arch rotation. While considering this, it should also be noted that, if a force is applied below the center of resistance at the maxillary complex there will be a clockwise rotation of the maxillary dentoalveolar complex [8]. it is very essential to have an in-depth understanding about how forces are applied and where the center of resistance lies so as to meet our aims in orthodontics. However, thinking about retraction of maxillary incisors post premolar extraction may lead to inadvertent flattening out of profile.

An optimal overjet and overbite were successfully attained in this instance, along with optimal inclination of incisors in both arches. The patient expressed great satisfaction with the appearance of the teeth and facial features, resulting in a more confident smile during the subsequent follow-up appointment [1].

Narrative synthesis of the literature (2005–2024)

To place the present case within the wider evidence base, the literature of the past two decades on the correction of bimaxillary dentoalveolar protrusion and on total-arch (en-masse) distalization with temporary anchorage devices was reviewed narratively. PubMed and Google Scholar were searched for

clinical studies, systematic reviews and illustrative case reports published between 2005 and 2024 using combinations of the terms bimaxillary protrusion, en-masse retraction, total arch distalization, infrazygomatic crest, buccal shelf, temporary anchorage device, miniscrew and self-ligating bracket. Reports were selected to represent the evolution of the field from extraction-based camouflage, through interradicular mini-implant anchorage, to contemporary extra-alveolar bone-screw distalization. The synthesis is presented in Table 2.

Table 2

Narrative synthesis of two decades of literature (2005–2024) on the correction of bimaxillary protrusion and on en-masse (total-arch) distalization with temporary anchorage devices.

Author (year)	Study design and sample	Intervention and anchorage	Key findings and relevance to the present case
Bills et al. (2005) [9]	Retrospective cephalometric study of patients with bimaxillary dentoalveolar protrusion	Four-premolar extraction and incisor retraction with conventional anchorage	Characterised the dentoskeletal and soft-tissue traits of bimaxillary protrusion and confirmed that extraction-based retraction reliably reduces incisor proclination and lip procumbence. Provides the conventional benchmark against which the present non-extraction result must be judged.
Upadhyay et al. (2008) [10]	Prospective clinical cephalometric study in adults	En-masse retraction of the maxillary anterior teeth with interradicular mini-implants	Mini-implants delivered essentially absolute anchorage with negligible molar mesial migration and allowed simultaneous retraction and intrusion of the incisors. First strong clinical evidence that skeletal anchorage outperforms compliance-dependent anchorage.
Chu et al. (2009) [8]	Narrative review of surgical-orthodontic management	Anterior segmental osteotomy and orthodontic camouflage	Defined the indications for surgery in severe protrusion and described the effect of the line of force relative to the centre of resistance of the maxillary complex. This principle governed the force vector planned in the present case.
Leonardi et al. (2010) [11]	Systematic review in non-growing patients with bimaxillary protrusion	Premolar extraction and incisor retraction	Soft-tissue response was variable and consistently smaller than the hard-tissue change, and flattening of the profile was a recognised risk. A central argument for considering a non-extraction alternative in borderline cases such as this one.
Solem et al. (2013) [3]	Retrospective three-dimensional imaging study	Extraction-based treatment of bimaxillary protrusion	Confirmed in three dimensions that soft-tissue change is not proportional to hard-tissue change, reinforcing the need for individualised planning of the amount of incisor retraction.

Author (year)	Study design and sample	Intervention and anchorage	Key findings and relevance to the present case
Chang, Liu and Roberts (2015) [12]	Retrospective cohort of 1680 extra-alveolar mandibular buccal shelf mini-screws	Buccal shelf screws placed in movable mucosa versus attached gingiva	Primary failure was substantially lower when screws were placed in attached gingiva. Established the buccal shelf as a dependable extra-alveolar site for mandibular total-arch distalization, the site used in this case.
Chen, Teng and Xu (2016) [2]	Case report with full cephalometric documentation; moderate Class I bimaxillary protrusion	Distalization of both dentitions with miniscrew anchorage	Showed that simultaneous maxillary and mandibular distalization can correct moderate protrusion without extraction. The closest published precedent to the present protocol.
Antoszewska-Smith et al. (2017) [13]	Systematic review and meta-analysis	Miniscrew implants versus conventional anchorage during en-masse retraction	Miniscrews were significantly more effective than conventional anchorage reinforcement, with roughly 2 mm less anchorage loss. Highest level of evidence supporting the anchorage strategy adopted here.
Wu et al. (2018) [14]	Prospective three-dimensional (cone-beam computed tomography) study	Maxillary total-arch distalization with infrazygomatic crest miniscrews	The maxillary dentition was distalized and the Class II relationship corrected in a mean of 8 months, with about 4.3 mm of incisor retraction. The 8-month distalization phase in the present case matches this reported mean.
Deshmukh and Vadera (2018) [6]	Case report	Non-extraction en-masse distalization of the maxillary dentition with miniscrews	Confirmed the clinical feasibility of maxillary arch distalization as an alternative to premolar extraction in protrusive cases.
Almeida (2019) [7]	Narrative review of biomechanics	Extra-alveolar mini-implants in the infrazygomatic crest and buccal shelf	Set out the rationale for extra-alveolar screw position, torque prescription and force magnitude. Directly informed the low-torque maxillary and standard-torque mandibular bracket prescription used here.
Villela (2020) [1]	Case report	Intra- and extra-alveolar miniscrews combined with a self-ligating bracket system	Combining extra-alveolar screws with passive self-ligation produced a low-friction environment favourable to full-arch retraction, with marked soft-tissue profile improvement. The conceptual basis of the present treatment.

Author (year)	Study design and sample	Intervention and anchorage	Key findings and relevance to the present case
Bayome et al. (2021) [15]	Systematic review and meta-analysis	Maxillary molar distalization with temporary skeletal anchorage devices	Pooled data confirmed clinically significant molar distalization with skeletal anchorage and quantified the movement achievable together with the associated anchorage loss.
Chang, Lin and Roberts (2022) [16]	Retrospective clinical study of infrazygomatic crest bone screws	Infrazygomatic crest screws; effects of age, insertion angle, sinus penetration and insertion torque	Identified the determinants of infrazygomatic screw success and reported high overall survival. Supports the use of extended-collar infrazygomatic screws between the maxillary first and second molars, as in this case.
Raghis et al. (2022) [17]	Systematic review and meta-analysis	Maxillary total-arch distalization with temporary anchorage devices in non-extraction treatment	Total-arch distalization with temporary anchorage devices produced effective and reasonably stable sagittal correction, supporting non-extraction management of the discrepancy.
Shaikh et al. (2022) [5]	Case report	En-masse distalization of Class I bimaxillary protrusion with the Damon system and infrazygomatic crest and buccal shelf bone screws	The protocol most directly comparable to the present case, reporting successful non-extraction correction of protrusion with profile improvement.
Ramsundar et al. (2023) [4]	Prospective clinical study	En-masse distal movement of the maxillary dentition with infrazygomatic crest anchorage	Reported dentoalveolar correction without compromise of the pharyngeal airway, addressing a frequent concern about arch distalization.
Setvaji and Sundari (2024) [18]	Systematic review following PRISMA and registered in PROSPERO	En-masse mandibular arch distalization with skeletal temporary anchorage devices	Mandibular total-arch distalization was effective in correcting borderline cases without surgery, confirming that the mandibular component of the present protocol is evidence-supported.

Considered as a whole, this body of work shows a clear evolution. Early studies characterised bimaxillary protrusion and treated it predominantly by four-premolar extraction [9], while demonstrating that the soft-tissue response is disproportionate to incisor retraction and that flattening of the profile is a genuine risk [3, 11]. The introduction of interradicular mini-implants greatly improved anchorage control [10, 13], and the subsequent move to extra-alveolar sites, namely the infrazygomatic crest in the maxilla and the buccal shelf in the mandible, made distalization of the whole arch predictable and largely independent of

patient compliance [7, 12, 16]. Systematic reviews now confirm clinically meaningful distalization in both arches [15, 17, 18], and case-based reports that combine extra-alveolar screws with passive self-ligation describe profile improvement comparable with that achieved by extraction [1, 2, 5, 6]. The present case is consistent with this evidence: an 8-month active distalization phase, in line with the mean reported by Wu et al. [14], produced 5 mm of lower incisor retraction and 2–3 mm of lip retraction while preserving sound teeth. The element that remains under-reported throughout this literature is long-term stability, which is also the principal limitation of this report.

Strengths and limitations

The principal strength of this report is that it documents, with complete pre-treatment, progress and post-treatment records, that simultaneous en-masse distalization of both arches with extra-alveolar bone screws and a passive self-ligating system can correct a borderline bimaxillary protrusion without extraction and without patient-dependent extraoral anchorage. Several limitations should nevertheless be acknowledged. As a single case report, the findings are descriptive and cannot be generalised, and no causal inference can be drawn in the absence of a comparison group. The assessment of tooth movement was based on two-dimensional lateral cephalometric superimposition, which is subject to landmark identification error and does not allow three-dimensional evaluation of root position, alveolar bone thickness or root resorption; cone-beam computed tomography was not obtained. Soft-tissue change was assessed clinically and photographically rather than by quantitative three-dimensional imaging, and the patient perspective was recorded informally rather than with a validated quality-of-life instrument. Finally, only short-term post-treatment follow-up is reported, so the long-term stability of the distalized dentition and of the soft-tissue profile remains to be confirmed.

CONCLUSION

This report describes the simultaneous distal movement of the upper and lower dental arches accomplished by utilizing E-A bone screws in combination with a passive type of self-ligation bracket system, serving as a non-extraction and non-traction approach to treating bimaxillary protrusion. The outcome revealed a pleasant smile, a calm lip closure, and harmonious facial aesthetics.

Abbreviations

ANB
A point–Nasion–B point angle
BSS
Buccal shelf screw
CARE
CAse REport (reporting guideline)
Cres
Centre of resistance

CuNiTi
Copper nickel-titanium
E-A
Extra-alveolar
IMPA
Incisor mandibular plane angle
IZC
Infrazygomatic crest
OPG
Orthopantomogram
SLB
Self-ligating bracket
SN
Sella–Nasion plane
SS
Stainless steel
TADs
Temporary anchorage devices
TMJ
Temporomandibular joint
U1-SN
Upper incisor to Sella–Nasion plane angle

Declarations

Ethics approval and consent to participate:

Ethical approval was not required for this single case report in accordance with the policy of the Institutional Ethics Committee of Datta Meghe Institute of Higher Education and Research, Sawangi (Meghe), Wardha. The patient provided written informed consent to participate. All procedures were carried out in accordance with the ethical standards of the institution and with the 1964 Declaration of Helsinki and its later amendments.

Consent for publication:

Written informed consent for publication of this case report and the accompanying images was obtained from the patient. The patient is a 25-year-old adult; consent was therefore given by the patient personally and consent from a parent, legal guardian or next of kin was not applicable. The patient was informed that the case details and images would be published under the relevant Creative Commons licence and would therefore be freely available on the internet, and consented on that basis. A copy of the written consent form is available on request for review by the Editor-in-Chief of this journal.

Patient anonymity

All images have been de-identified. The extraoral photographs (Figs. 1 and 8) have been cropped so that only the lower third of the face — the jaw, jawline and perioral region relevant to the treatment outcome — is shown, and the eyes, nose and other facial features have been removed. All patient identifiers, including name, sex, date of birth, examination date, hospital record and accession numbers, have been permanently removed from the radiographic images (Figs. 3, 4 and 6).

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

U.C. and A.K wrote manuscripts P.C. prepared figuresP.D. reviewed manuscripts

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Availability of data and materials:

All data generated or analyzed during this study are included in this published article.

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Figures



Figure 1

Pre-treatment extraoral photographs:(A)Left lateral profile, (B)Frontal at occlusion, (C)Frontal at smiling.

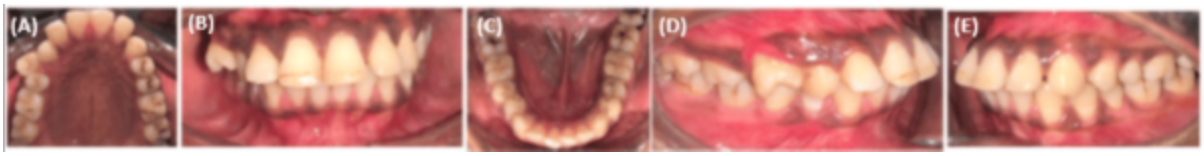


Figure 2

Pretreatment Intraoral Photographs: (A) Maxillary arch, (B)Frontal at occlusion (C)Mandibular arch (D)Right lateral occlusion (E)Left lateral occlusion



Figure 3

Pretreatment radiograph:Orthopantomogram



Figure 4

Pretreatment lateral cephalogram



Figure 5

Mechanics: (A) Maxillary arch, (B) Frontal at occlusion, (C) Mandibular arch, (D)Right lateral occlusion, (E) Left lateral Occlusion





Figure 6

Stage orthopantomogram

Stage lateral cephalogram



Figure 7

Postoperative Intraoral Photograph: (A) Maxillary arch, (B) Frontal at occlusion, (C) Mandibular Arch, (D) Right lateral Occlusion, (E) Left Lateral Occlusion

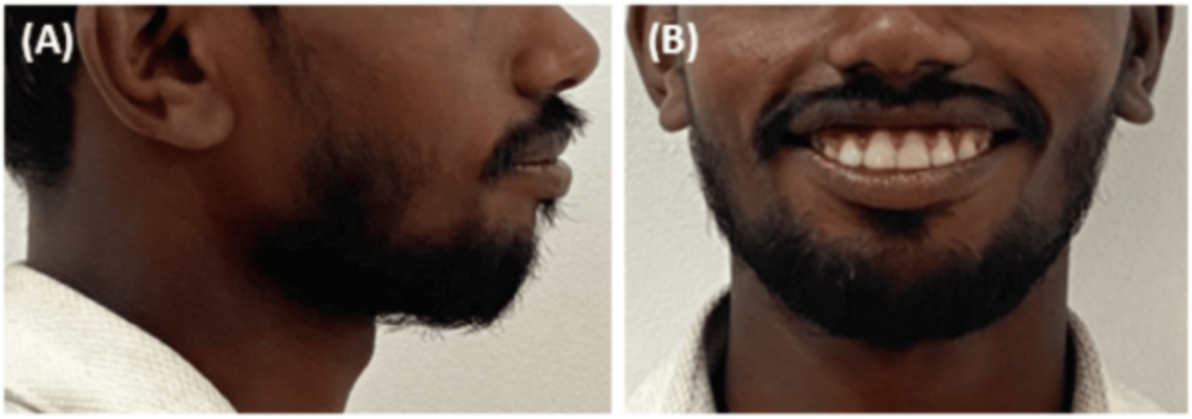


Figure 8

Postoperative Extraoral Photographs: (A) Left lateral profile, (B) Frontal at smiling