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RESEARCH ARTICLE

GROWTH MODIFICATION THERAPY FOR COMPREHENSIVE MANAGEMENT OF SKELETAL DISCREPANCY IN SAGITTAL PLANE: A CASE SERIES

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Abstract

Skeletal discrepancies in the sagittal plane—particularly skeletal Class II and ClassIII malocclusions—are commonly encountered in growing orthodontic patients. Early orthopaedic intervention during the growth period offers a non-invasive approach to modify unfavourable growth patterns and improve jaw relationships.Aim is to present and evaluate the clinical outcomes of two growth modification approaches—facemask therapy with rapid maxillary expansion (RME) for skeletal Class III malocclusion with maxillary retrusion, and twin block appliance therapy for skeletal Class II malocclusion with mandibular retrognathia.

Introduction:-

Skeletal discrepancies in the sagittal dimension represent a significant subset of orthodontic malocclusion encountered. These disharmonies broadly classified as skeletal class II or class III patterns result from imbalance in the anteroposterior relationship of maxilla and mandible[1] These may stem from variety of etiological factors, including genetic predispositions, environmental influences and functional adaptationsif left untreated, these conditions can result in not only compromised functional occlusion but also significant alteration in facial aesthetics, speech development, airway dimension, masticatory efficiency and psychosocial health[2,3].Orthopaedic growth modification therapies aim to address such discrepancies at their source i.e skeletal structure rather than merely compensating with dental camouflage. This offers a unique opportunity to intervene during active stage of skeletal development, redirecting and enhancing the growth of craniofacial complex[4].The success of such intervention is highly dependent on precise diagnosis, optimal timing- often during peak pubertal growth spurt and the appropriate selection of treatment mechanics tailored to the individual patient's growth pattern and skeletal discrepancy[5,6]Treatment strategies differ based on the nature of the skeletal imbalance. In skeletal class III cases characterised by maxillary retrusion, orthopaedic protraction techniques have been shown to stimulate anterior maxillary displacement. Combined use of RME (Rapid maxillary expansion) and facemask therapy remains a

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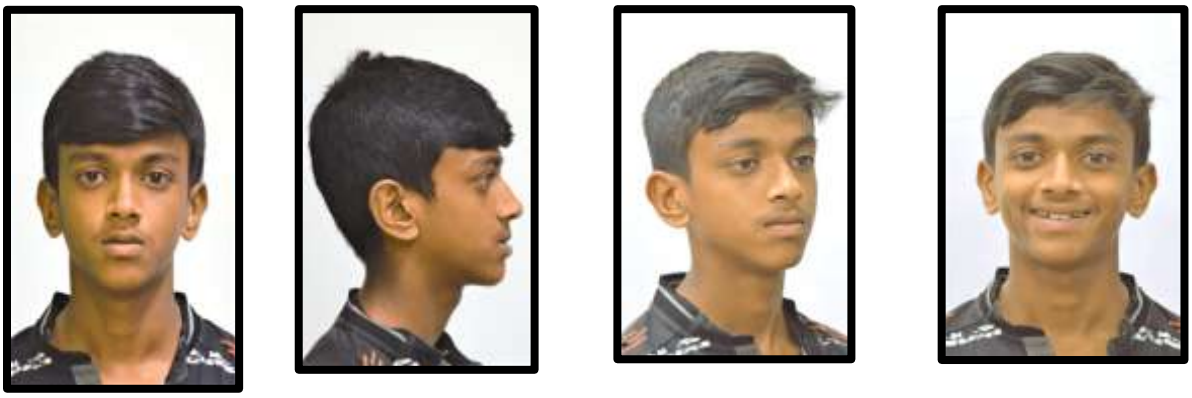
widely accepted and evidence supported approach. RME facilitates loosening of the circum-maxillary sutures, enhancing orthopaedic effect of facemask traction and promoting forward and downward growth of maxilla. This protocol is particularly beneficial prior to or during early mixed dentition phase when suture patency and growth potential are highest[7,8]On the other hand skeletal class II malocclusion due to mandibular retrognathia are commonly addressed with functional appliances that posture the mandible forward.

Among the functional appliances, twin block appliance has gain prominences due to favourable compliance profile and capacity to induce true mandibular growth by altering neuromuscular balance and encouraging adaptive remodelling at the condylar level when used during peak pubertal growth[9,10].This case series presents two distinct yet complementary cases of sagittal skeletal correction achieved through growth modifications. First case involves a growing patient with maxillary retrusion and skeletal class III malocclusion treated using RME combined with facemask therapy, second case features a patient with skeletal class II malocclusion due to mandibular retrognathia, successfully managed with twin block appliance therapy.

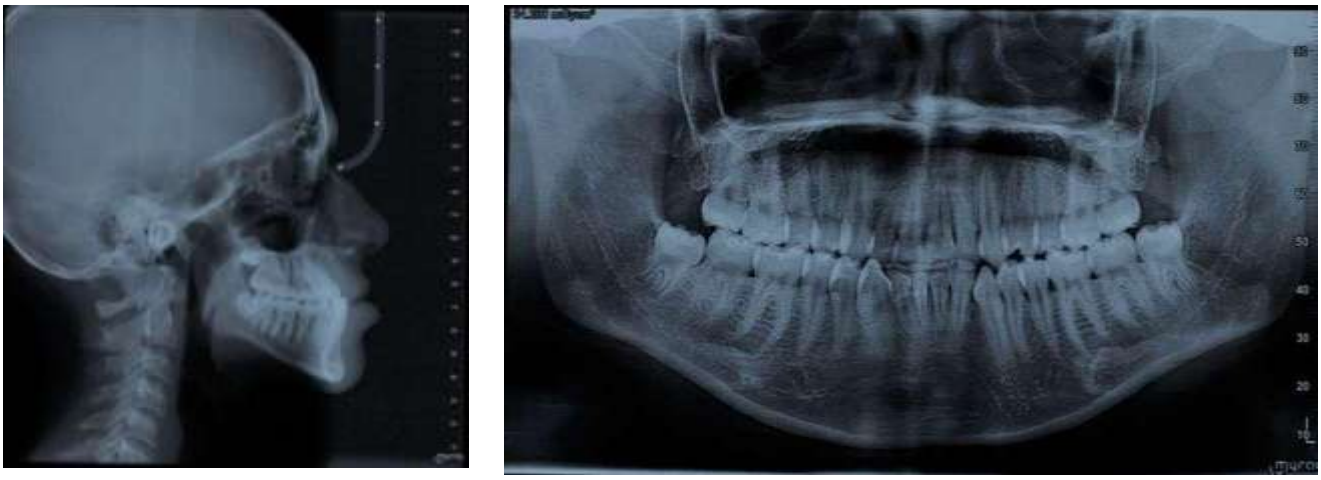
CASE REPORT 1:-

A 14 years old male patient reported to the department with the chief complaint of forwardly placed lower front teeth. The extraoral examination revealed a mesoprosopic facial form, concave profile,retrusive upper and protrusive lower lip. The intraoral examination revealed proclined maxillary and retroclined mandibular anterior teeth with cross-bite in 11,12,13,21,22 region and a negative overjet of 1mm is observed.The cephalometric analysis revealed a class III skeletal base, a retrognathic maxilla (SNA=79˚) and a prognathic mandible (SNB=84˚). The skeletal age of the child was determined as CVMI stage 3 which suggested that at least 25 to 65% growth was still expected (Fig3).



(Fig 1: Exraoral pre treatment photographs)

(Fig 2: Intraoral pre treatment photographs)



(Fig 3: pre-treatment radiographs)

DIAGNOSIS:-

A 14 years old male growing patient in CVMI stage 3 with Angle's class III malocclusion on class III skeletal bases. Proclined upper anteriors and retroclined lower anteriors with crossbite i.r.t 11,12,13,21,22 region and a negative overjet of 1mm with concave profile

TREATMENT OBJECTIVES:-

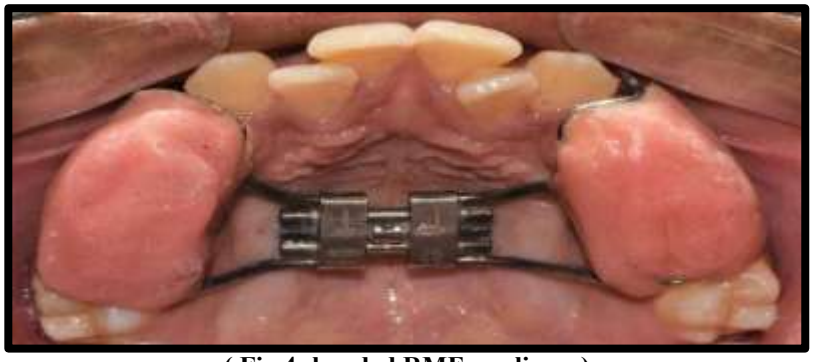
1. To correct the skeletal class III relation and concave profile
2. To correct the crossbite and attain normal overjet and overbite
3. To attain class I molar, canine relation bilaterally
4. To correct the inclination and align the retroclined lower and proclined upper anteriors over the basal bone
5. To improve the smile, aesthetics and overall appearance

TREATMENT PLAN:-

The patient was planned to be treated in two phases. Phase I treatment consisted of use of rapid maxillary expander according to Alt-RAMEC protocol, followed by protraction by petit type facemask. After correction of skeletal problem, dentoalveolar correction was done in phase II by self-ligating pre adjusted edgewise appliance using MBT 0.022 slot continuous arch mechanics as there was still crowding present which needed expansion of the arches. Retention planned was Frankel III /Class III Bionator and Fixed lingual spiral wire retainer from canine to canine in both arches.

TREATMENT PROGRESS: -

An RME(hyrax) was cemented and activatedsuch that maxilla is expanded at the rate of 1mm/day for the first week by opening the screw and then this screw is closed at rate of 1 mm/day in the second week. This is continued for 7-9 weeks



(Fig 4: bonded RME appliance)

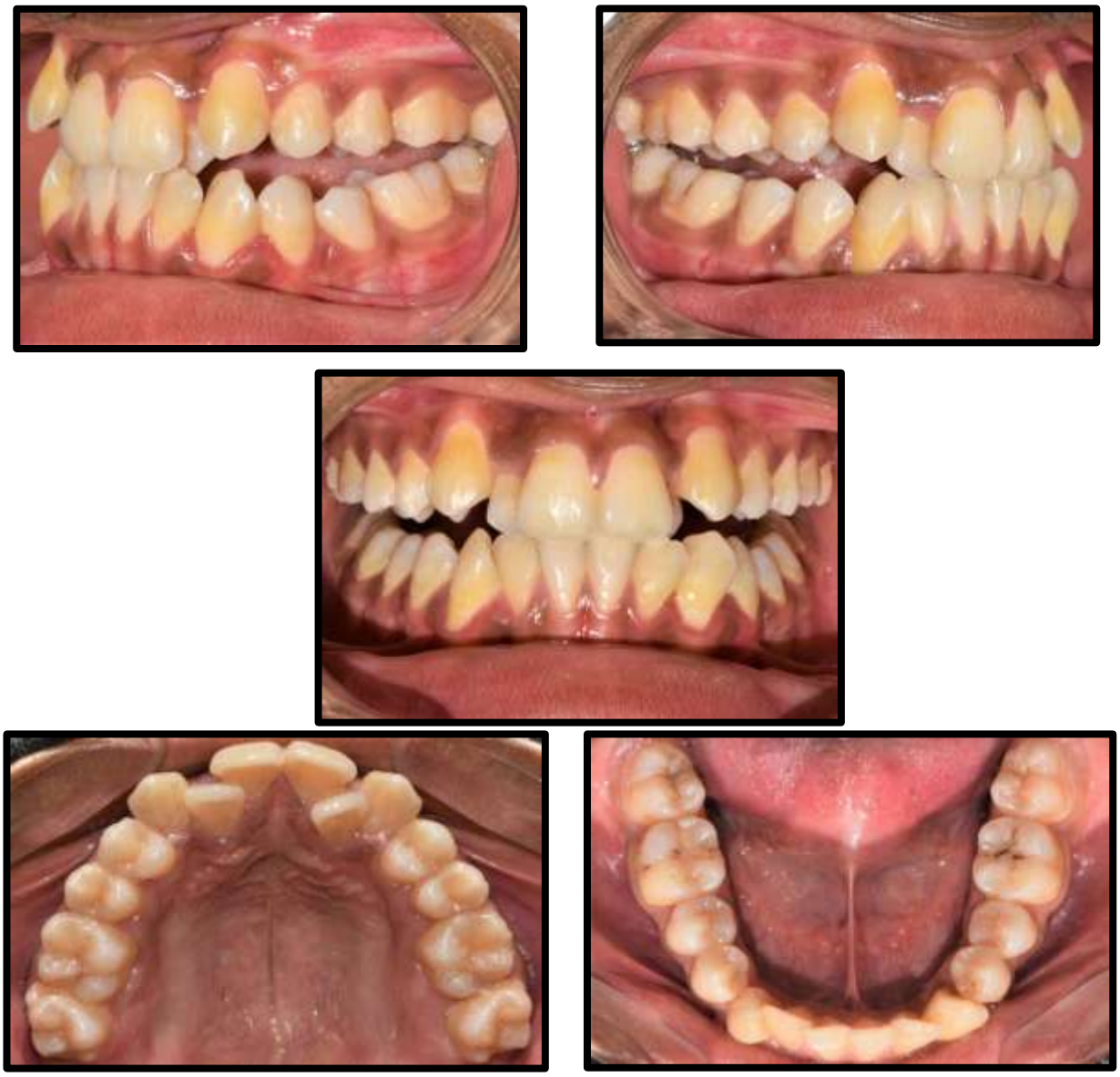
After 4 weeks of the bonded appliance, facemask use was initiated and continued for 6 months, for at least 16 hours a day.

(Fig 5: extraoral photographs of patient wearing petit type facemask)

The extraoral elastics protocol followed was: 3/8", 8 oz, then ½", 14 oz and finally 5/16", 14 oz. The phase 1 treatment was completed by 8 months, following which, a retention plate was kept in place for 3 months.

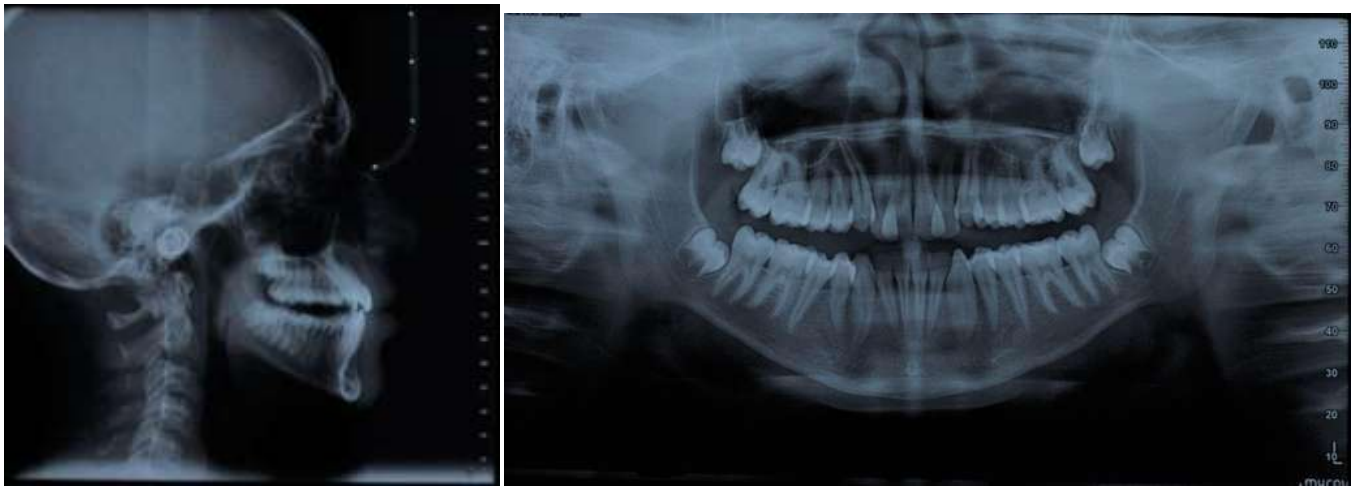
(Fig 6: retention plate after phase I therapy)

(Fig 7: extraoral mid treatment photographs



(Fig 8: Intraoral mid treatment photographs)

(Fig 9: mid treatment radiographs)

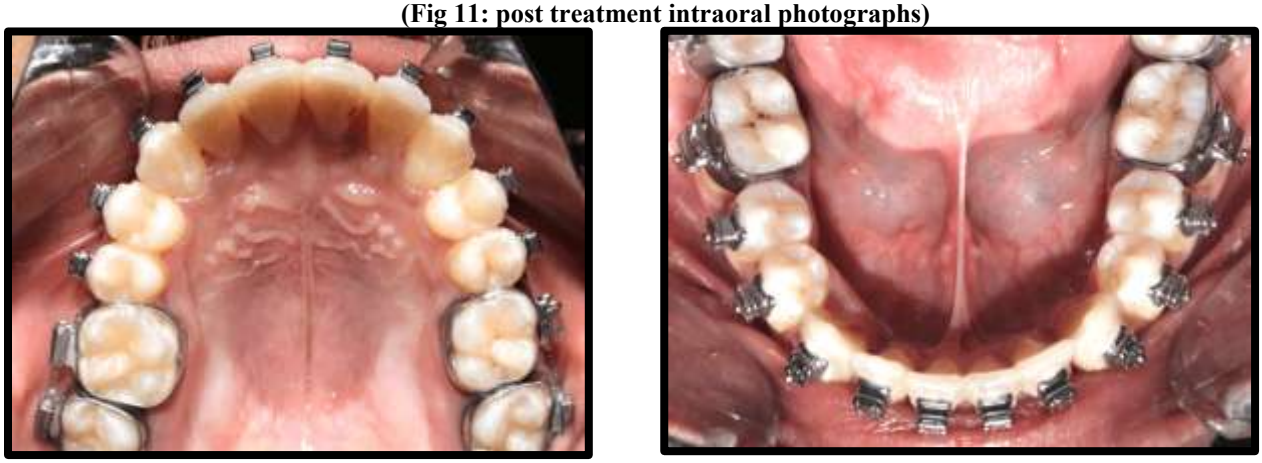


The ANB angle improved, mandibular plane angle increased, anterior crossbite was corrected and the upper incisors were labially inclined. Later, a full mouth, fixed, self ligating appliance was used to treat the patient for another 8 months.

Treatment Result:-

(Fig 10: extraoral post treatment photographs)

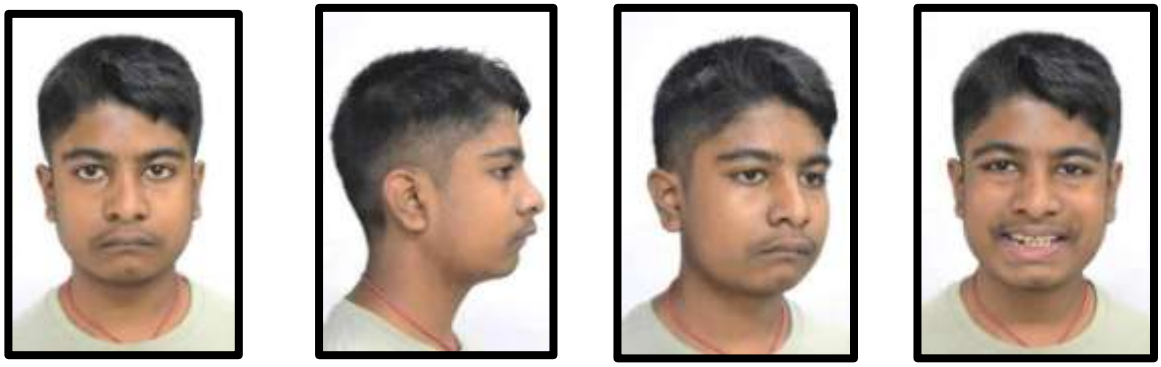
(Fig 11: post treatment intraoral photographs)



After 19months of treatment, an acceptable occlusion, overbite and overjet was achieved.The patient displayed a bilateral Class I canine and a Class I molar relationship. The arch forms were symmetrical and well-aligned. The SNA angle had increased. Normal overbite (1 mm) and overjet (2 mm) were achieved, and the midlines were centered. Vertical skeletal measurements remained nearconstant. Harmonious occlusion was established; lateral and jaw-opening excursions were smooth and straight

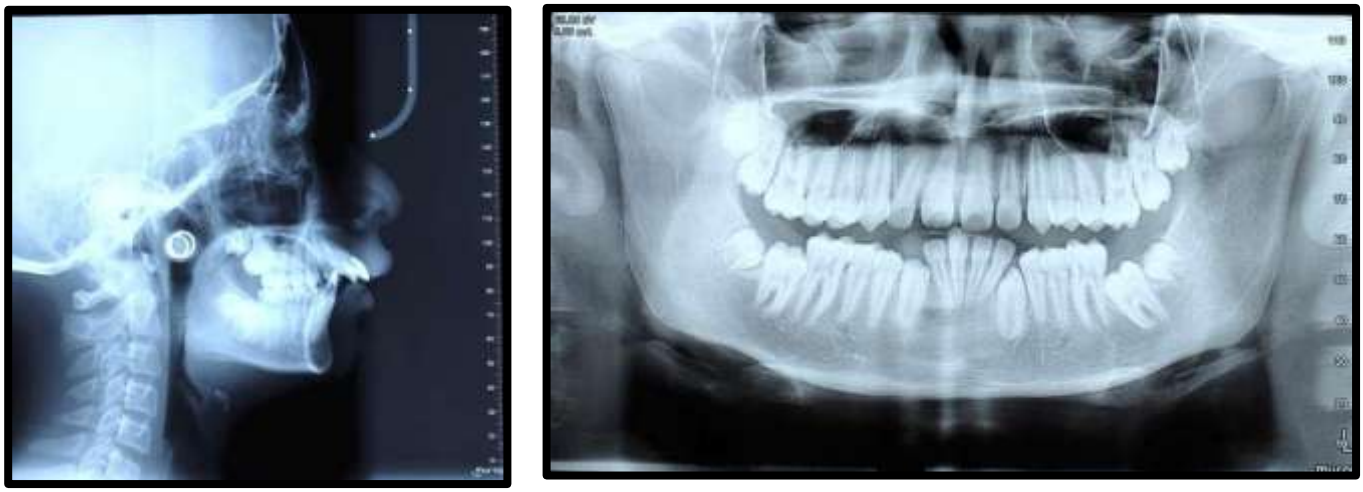
CASE 2

A 13 years old male patient reported to the OPD with the chief complaint of forwardly placed upper front teeth. No relevant medical or dental history reported.Extraoral examination (fig 1) revealed a mesoprosopic facial type, retrognathic mandible, convex profile and recessive chin. No abnormality was detected in the temporomandibular joint. Intraoral examination (fig 2) revealed class II molar relationship, deep and complete overbite, 12 mm of overjet, spacing in upper anterior region, lower midline is shifted 2mm towards left side. The lowerleft side canine was not erupted. Cephalometric values showa case of skeletal class II jaw base with ANB angle of 6˚ and Wit's appraisal of +4mm. An SNB angle of 76.5˚ suggestive of retrognathic mandible. The skeletal growth pattern was horizontal as evidenced by SN-MP angle of 20˚. Maxillary incisors were proclined with UI-NA 10mm/38˚ and mandibular incisors were retroclined with LI-NB 5mm/18˚. Cervical vertebrae indicated transition period of growth, CVMI stage 3.



(Fig 12: Extraoral pre treatment photographs)

Fig 13: Intraoral pre treatment photographs)



(Fig 14: pre treatment radiographs)

DIAGNOSIS: -
A 13 years old male growing patient in CVMI stage 3 with Angle's class II div 1 malocclusion on class II skeletal bases with horizontal growth pattern. Proclined upper anteriors with protrusive upper lip and lower lip trap, recessive chin. There was a complete deep bite and overjet of 12mm with a convex profile.

TREATMENT OBJECTIVES: -

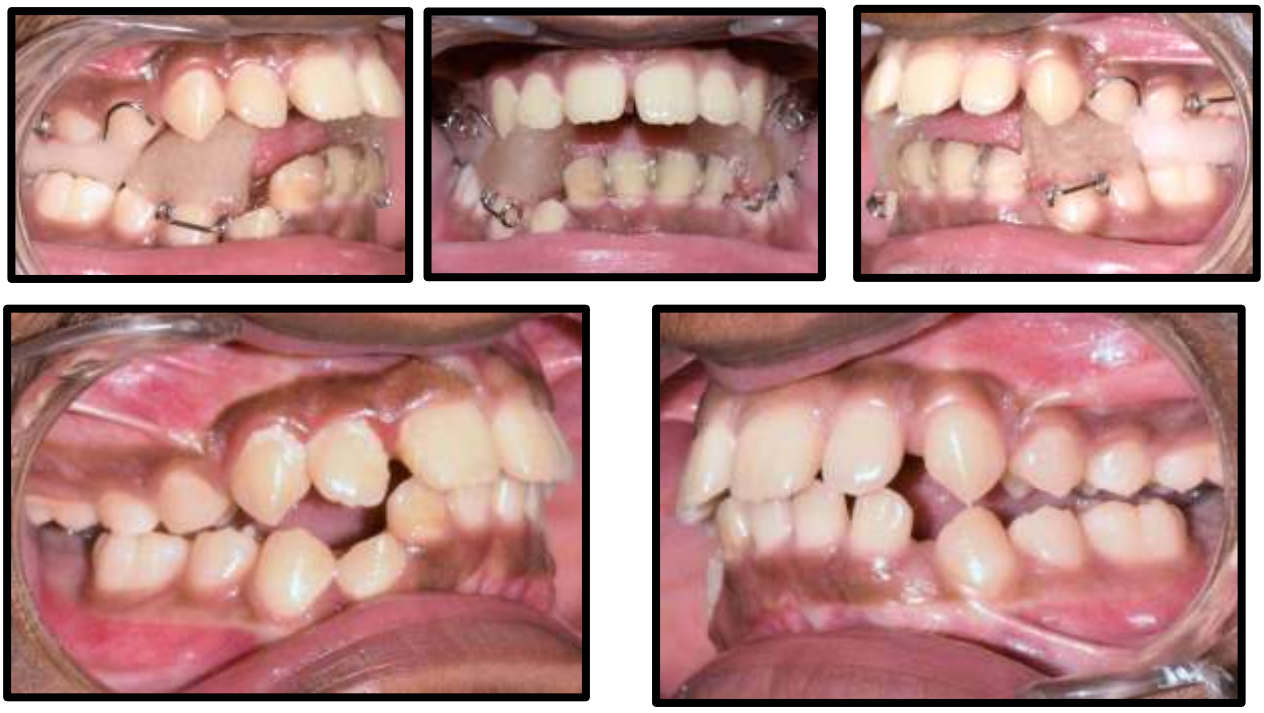
- To correct the underlying skeletal discrepancy.
- To attain normal overjet and overbite.
- To correct the inclination and align the proclined upper and lower anteriors in the basal bone.
- To attain class I molar relation and class I canine relation bilaterally.
- Toattain a proper lip relationship.
- To improve the smile and aesthetics and overall appearance

TREATMENT PLAN: -
Since the patient had favorable growth potential with clinically positive VTO, patient was planned to be treated in two phases.

PHASE I: GROWTH MODIFICATION THERAPY
Involved use of removable Twin Block myofunctional appliance to advance mandible, to reduce overjet and to achieve a skeletal class I relationship.

PHASE II:-
Fixed mechanotherapy with MBT 0.022 slot preadjusted edgewise brackets using continuous arch mechanics. The patient also had an impacted lower left permanent canine which was surgically exposed and attachment placed intraoperatively. Traction was given from the mainarchwire to pull the canine into the arch.

Retention Protocol:-
Modified Hawley's retainer with an anterior arch.



(Fig:16 post phase I intraoral photograph)

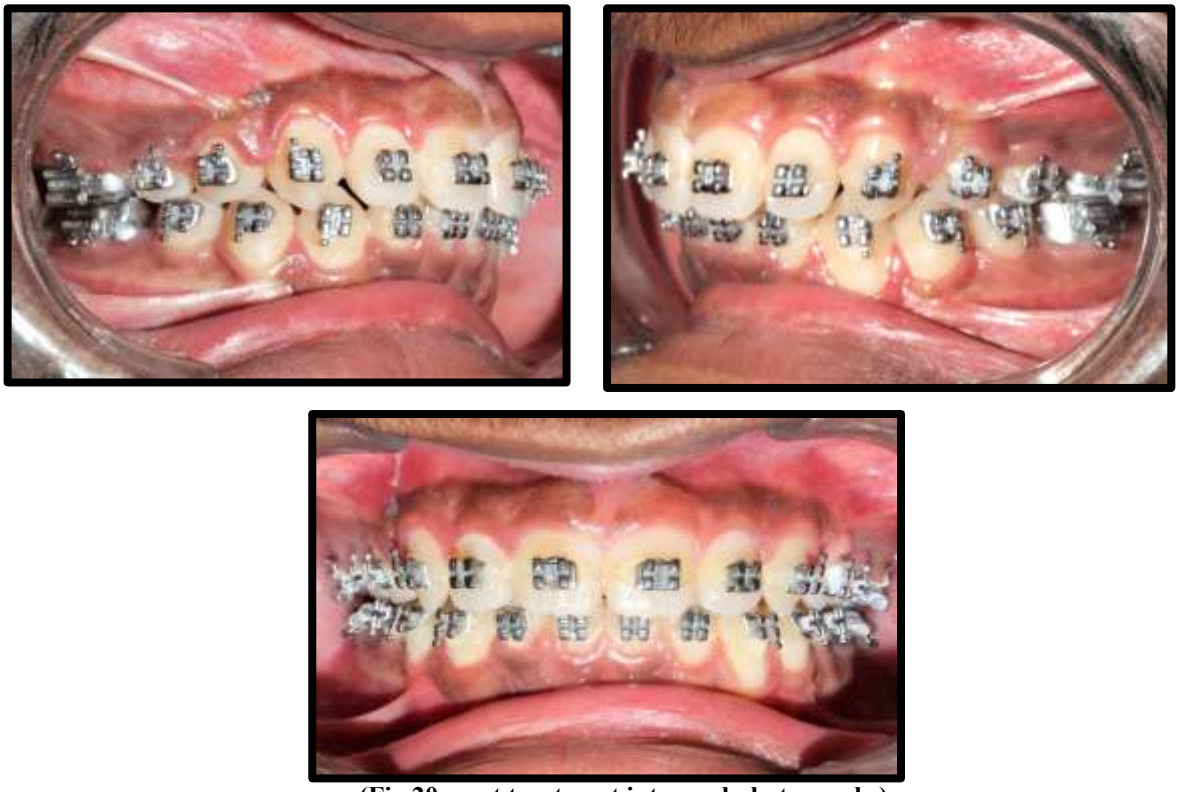
(Fig 17 Retention appliance)

(Fig 18 Surgical exposure of canine)

TREATMENT RESULT

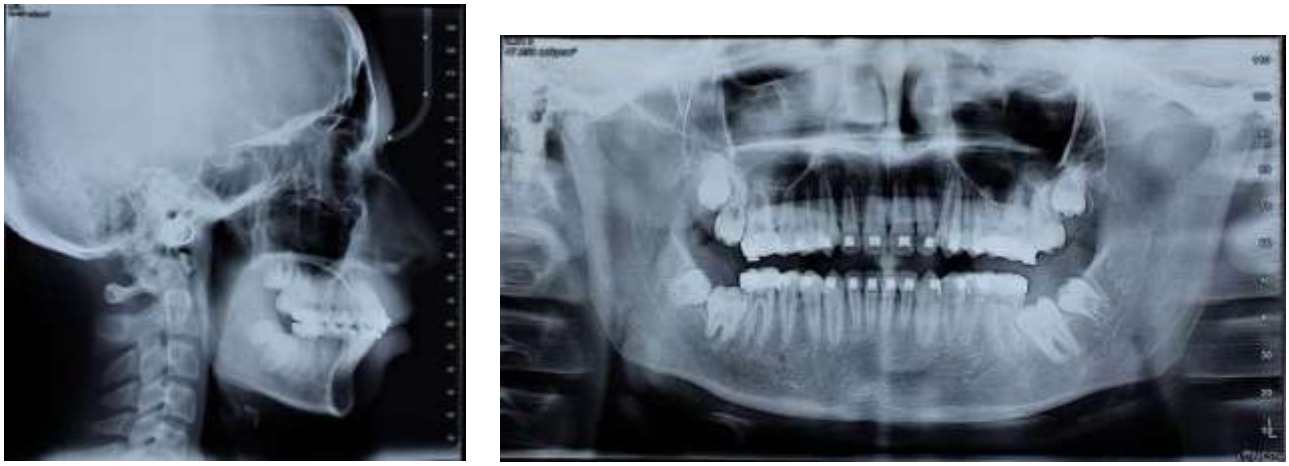
The most impressive result was the improvement in the patient's facial profile and esthetics. With the twin block appliance therapy, the mandible was advanced converting skeletal class II relationship to skeletal class I relationship. A bilateral class I molar relationship was achieved. Post treatment intraoral photographs and lateral cephalogram shows that maxillary and mandibular incisors were inclined appropriately. The panoramic radiograph shows adequate parallelism of roots in both upper and lower arches.

(Fig 19: extraoral post treatment photographs)



(Fig 20: post treatment intraoral photographs)

(Fig:21 post treatment radiographs)



Discussion:-

Early diagnosis and intervention for orthopedic management of skeletal discrepancies are critical in interceptive orthodontics[5]. This case series very well illustrates the effectiveness of growth modification strategies in influencing skeletal growth favorably and improving facial esthetics during patient's developmental years. This potentially reduces the need for surgical correction in adulthood[4,7].Both the cases employed distinct treatment modalities aligned with the underlying skeletal pattern and patient's stage of growth, demonstrating the importance of individualized, etiology-driven approaches in clinical orthodontic practice[1].The first case employed combined use of rapid maxillary expansion and protraction facemask therapy to correct skeletal class III malocclusion due to maxillary retrusion which is a common etiological factor in class III cases among Indian population[11]. The RME serves to open the circum-maxillary sutures, thereby enhancing the orthopedic effect of anterior traction delivered by facemask[8]. Implanting this method has shown consistent improvement in SNA and ANB angles, with favorable changes in overjet and soft tissue profile[12].

The timing of intervention is critical, as skeletal responsiveness diminishes significantly with increasing age The second case of mandibular retrognathia managed using a functional orthopedic i.e. twin block appliancedesigned to posture the mandible forward, stimulating the growth at condylar cartilage and promoting remodeling at glenoid fossa[9]. The success of such appliances is closely linked to patient compliance and treatment timing, with the greatest skeletal effect observed during pubertal growth spurt[10]. In the present case, treatment yielded a more favorable jaw relationship, reduced overjet and improved facial profile.Considering cephalometric analysis, assessment of skeletal maturity and patient specific growth pattern are essential in selecting the mostappropriate growth modification approach[13]. The contrast between these two cases underscores thediversity of of therapeutic pathways within orthopedic orthodontics, where the direction and nature of skeletal changes guide appliance selection.

Despite the encouraging results observed in both patients, it is important to acknowledge the limitations inherent to growth modification. The effectiveness of these protocols is closely linked to treatment timing and patient compliance[6]. Additionally skeletal changes may be influenced by genetic factors that are beyond the control of therapeutic interventions[14]. Long term retention and follow-up are necessary to ensure stability, especially in cases treated during early growth stages[15].

Conclusion: -

Growth modification remains a cornerstone in the early management of skeletal discrepancies when appropriately timed and carefully planned. This case series underscores the efficacy of interceptive orthodontic interventions such as rapid maxillary expansion with facemask therapy and twin block functional appliances in redirecting unfavorable growth patterns during active developmental phases. The positive skeletal and esthetic outcomes achieved in both Class III and Class II malocclusions reflect the importance of individualized diagnosis, growth assessment, and appliance selection based on the underlying etiology. While orthopedic therapies are not without limitations—such as dependency on growth potential and patient compliance—they offer a valuable non-surgical alternative for improving jaw relationships and facial harmony. Continued follow-up into post-growth years remains essential to ensure long-term stability and retention of treatment benefits.

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