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Buccal Shelf Implants For En-Masse Distalization Of Mandibular Arch – A Case Report On Non-Surgical Correction Of Skeletal Class III Discrepancy

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Abstract: Treating class III malocclusion is always tricky and difficult. The first step in the treatment of class III malocclusion includes identifying the patients' problems, along with etiology and chief complaint after that proper diagnosis of patients skeletal and dental structure and his/her growth status.

Class III malocclusion with skeletal problems can be identified at an early age and can be treated by orthopedic means like face mask and chin cup. There are newer methods like ALT-RAMEC which uses circum-maxillary sutures for its action which will give good mid-facial esthetics along with class III dental correction.

Myofacial appliances can be used for growing patients. However, adult patients with severe class III skeletal problems need surgical intervention.

Temporary Anchorage Devices (TADs) can be used in patients with mild to the moderate discrepancy, thus avoiding the need for surgical intervention. This article includes a case report of an adult class III patient treated using Buccal shelf bone screws, for En-masse distalization of the mandibular arch, thus correcting the Class III Skeletal discrepancy and avoiding the need for any invasive surgical approach.

Keywords: Buccal shelf implants, Bone screws, Mandibular distalization, En- masse distalization, Skeletal Class III

INTRODUCTION

A Class III malocclusion is defined as an abnormal relationship of the arches where all the lower teeth occlude mesial to normal, with the cusp of the upper second premolar in the sulcus between the mesio-buccal and middle buccal cusps of the lower first molar.[1] Class III malocclusion has very less prevalence and occurrence[2].The prevalence of this malocclusion varies among the different ethnic groups[3]. The frequency of Class III malocclusions varies in different racial groups. The incidence among white people is 1% to 4%; among black people, it is 5%to 8%; in Asians, it ranges from4%to 14%.[1-3] The etiology of this condition varies from 1 person to the next; implicated factors include heredity— eg, the Hapsburg chin; environmental influences—eg, anterior functional shifts of the mandible or mouth breathing, which can become a positive stimulus for mandibular growth; and pathologies— eg, pituitary tumors responsible for acromegaly.[11] Orthognathic surgery is the option for very severe malocclusion, on the other hand, orthodontic camouflage can be attempted in mild to moderate cases.[4-5] Camouflage in the past has been attempted with various approaches such as single lower incisor extraction, high pull headgear, molar protraction, and class III elastics[4-6] Camouflage treatment can be attempted with two approaches: in first approach extraction of teeth is done either lower premolar or lower incisor.[7-9] In the second approach mandibular molar distalization can be attempted with the help of bone screws incorporated in various locations like mandibular Buccal shelf area, Ramus or Retromolar area of the mandible. Distalization of whole mandibular dentition using Buccal Shelf implants has been proved to be a very efficient and effective way to avoid a surgical setback with Bilateral Sagittal Split Osteotomy in mild to moderate Class III discrepancy cases. The following case report includes the use of buccal shelf implants to correct class III malocclusion, thus significantly improving the patient's facial profile.

CASE REPORT

A male patient, aged 25 years reported to the clinic with a chief complaint of forwardly placed lower front teeth. The patient's medical history was non-contributory and there was no family history of similar dentition.

Pre-treatment extra-oral photographs showed a concave facial profile with a Class III skeletal pattern **(Figure no 1, 2)**

No facial asymmetry was noted on frontal photographic analysis. There was slight mandibular prognathism and the patient presented with an anterior divergence of the face.

Dental examination revealed a Class III molar relation. Anterior edge to edge incisor relation with class III canine relationship **(Figure no 3-5)**

There was a midline diastema between the upper central incisors. The lower dental midline was shifted to the left. The cephalometric analysis showed a Skeletal Class III relationship with an average mandibular plane angle and a slightly retrognathic maxilla. The anterior facial height was slightly long relative to the posterior facial height.

The incisor position and interincisal relationship were within normal limits except for the retroclined maxillary incisor.

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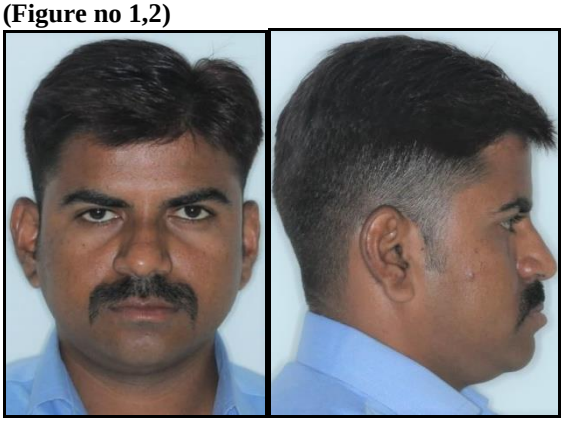
The patient was diagnosed with a skeletal Class III malocclusion with mild maxillary deficiency and a dental Class III relationship.

PRE-TREATMENT EXTRA-ORAL PHOTOGRAPHS (Figure no 1,2)



PRE-TREATMENT INTRA-ORAL PHOTOGRAPHS (Figure no 3,4,5)

LIST OF PROBLEMS

1. Prognathic mandible
2. Retrognathic maxilla
3. Concave profile with skeletal class III pattern
4. Prominent chin
4. Angle's class III molar and canine relationship
6. Edge to edge incisal bite
7. Proclined upper and retroclined lower incisors

PRE TREATMENT RADIOGRAPHS (Figure no 6,7)

TREATMENT OBJECTIVES

Based on the initial records and the patient's desires, the treatment objectives were to distalize all mandibular teeth, improve the interincisal relationship to have normal overjet and overbite, correct the maxillary midline diastema and achieve Class I canine and molar intercuspal relationships. A conventional fixed appliance was prescribed followed by distalization of the entire mandibular arch with the help of Buccal shelf implants.

TREATMENT PLAN

En- masse mandibular distalization with the help of Buccal shelf bone screws was planned in order to achieve goals of facial aesthetics, functionally optimum occlusion, minimum trauma to the patient and to achieve a straight facial profile. Cephalometric analysis was performed with pretreatment radiographic records which included lateral cephalograms and orthopantomogram (OPG). Radiographs revealed a Class III skeletal pattern with mild maxillary deficiency, mandibular prognathism, increased vertical chin height, an increased maxillary dental and skeletal height, and upper anterior proclination with lower anterior ratiocination **(Figure no 6, 7)**. After a combined clinic discussion weighing the pros and cons of a surgical versus a non-surgical approach, it was planned to perform En- masse mandibular distalization with the help of Buccal shelf bone screws for correction of mandibular prognathism and the reverse overjet to obtain facial aesthetics and an optimum functional occlusion. 3rd molars were present in this patient and were extracted at the start of the treatment.

TREATMENT PROGRESS

Fixed orthodontic treatment started with the bonding of maxillary and mandibular dentition using MBT 0.022" brackets. Leveling and alignment of maxillary and mandibular dentition were done using 0.016" Niti wires followed by 16*22" ,17*25" and 19*25" rectangular Niti wires and 19*25" Stainless steel wires. Buccal shelf bone screws were placed in the mandibular buccal shelf area**(figure no 8)**. Bone quality in the mandibular arch was good so implants were loaded immediately. Distalization of the mandibular arch was carried out using power chains attached to mini-screws. Distalization was continued for a period of 14 months until the class I molar relation was achieved.**(figure 9-11)** At the end of the treatment class, I skeletal and dental relation was achieved **(figure 17-21)**. Retention was given by using Hawley's retainers in the upper and lower arch. **(figure22-26)**

PLACEMENT OF BUCCAL SHELF SCREWS AFTER LEVELLING AND ALIGNMENT- (Figure no 8)

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MID TREATMENT INTRA-ORAL PHOTOGRAPHS- (Figure no 9,10, 11)

CEPHALOMETRIC VALUES

VARIABLE	PRE-TREATMENT	POST-TREATMENT	CHANGE	ONE YEAR FOLLOW-UP
SNA	79°	81°	2°	82°
SNB	86°	80°	-6°	80°
ANB	-7°	1°	8°	2°
WITS	-4mm	2mm	6mm	2mm
N ⊥ Pt A	1mm	0mm	-1mm	0mm
N ⊥ POG	4 mm	-4 mm	-8 mm	-4 mm
Angle of inclination	82°	85°	3°	85°
Go-Gn to SN	32.5°	32°	-0.5°	32°
Eff. Max. Length	90 mm	89 mm	-1 mm	89 mm
Eff. Man. Length	129 mm	121 mm	-8 mm	121 mm
Y- Axis	62°	69°	+7°	69°
Facial axis	-2°	-3°	-1°	-3°
Upper incisor – NA	24 mm	16 mm	-8 mm	16 mm
Upper incisor – NA	55.5°	32°	-23.5°	32°
Upper incisor – SN	130°	113°	-17°	113°
Upper incisor to maxillary plane angle	138°	120°	-18°	120°
Lower incisor to mandibular plane angle	101°	94°	-7°	94°
Lower incisor to NB	18 mm	8 mm	-10 mm	8 mm
Lower incisor to NB	42°	27°	-15°	27°
Interincisal angle	98°	128°	+33°	128°
Maxillary mandibular planes angle	35°	28°	7°	28°
Upper anterior face height	55 mm	58 mm	+3 mm	58 mm
Lower anterior face height	80 mm	78 mm	-3.5 mm	78mm
Face height ratio	46%	47%	+1%	47%
Lower incisor to APo line	19 mm	7 mm	-12 mm	7 mm
Lower lip to Ricketts E Plane	10 mm	3 mm	-7 mm	3 mm

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DISCUSSION

This case report emphasizes on the treatment of an adult Indian male patient with dental and skeletal class III relationships, having a mild maxillary deficiency and a mandibular excess. En- masse mandibular distalization with the help of Buccal shelf bone screws for achieving an acceptable occlusion and a good esthetic result was the best option in this case. Rivera et al reported that patients underwent orthognathic surgery to improve esthetic, functional problems. But, these benefits from orthognathic surgery are not always realized[10]. The main reason for not a very satisfactory treatment outcome could be a relapse of surgical changes. It has been reported that the relapse following mandibular setback is one of the highest for a surgical procedure.[11,12] [13]Establishing common objectives concerning the outcome of proposed surgical orthodontic therapy is a very important part of the treatment planning process. Hence an experienced multidisciplinary team approach delivers a satisfactory outcome.[14] Most relapses after setback surgery occurs during the postsurgical phase in the first two months following surgery. Similar findings were reported by Mobarak .[15] An additional minor relapse during the span from two months to a year after surgery. Minimal relapse beyond the first post-postoperative year, similar to that reported by Eggensperger et al was observed[16]. This rebound tendency affects not only the final occlusion but also the facial esthetics. In Class III lower jaw setback surgery, many surgeons tend to push the segments backward during the fixation procedure. However, this seems to be the main reason for the forward relapse of mandible in the majority of the mandibular setback surgery subjects. Keeping all these factors into account, it was planned to go ahead with a non-surgical approach by en masse distalization with the help of buccal shelf implants. This not only reduced the invasiveness and risks associated with a surgical approach but also proved to be more efficient and effective than a surgical bilateral sagittal split osteotomy setback procedure. Distalization was discontinued after the desired results were achieved, both in the patient's facial profile as well as the molar relation bilaterally. Good dental retention was a very important contributor to retain the final occlusion that was achieved with the buccal shelf bone screws, ensuring occlusal stability, which surely had positive repercussions on the final tissue stability. The facial changes that resulted from the treatment were pronounced and greatly improved the patient's self-image and self-confidence.

RESULTS

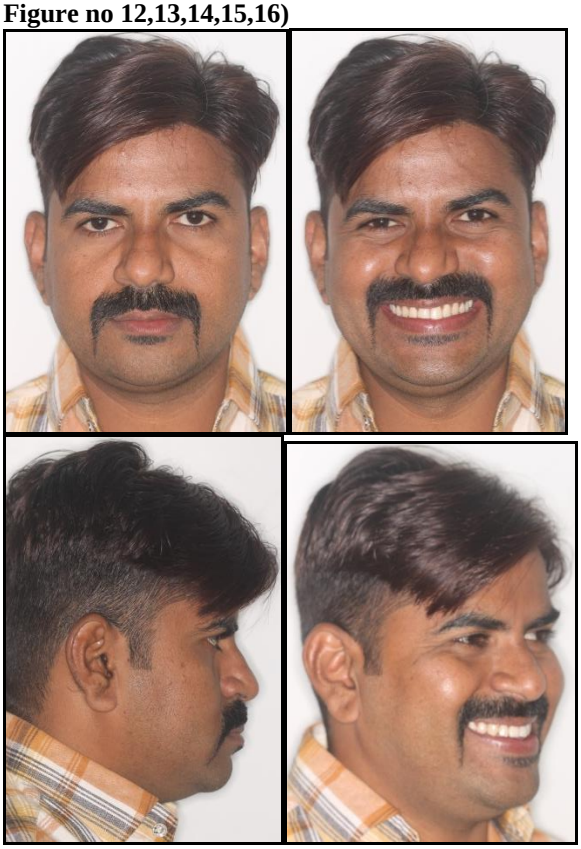
Skeletal changes — There was an increase in SNA angle and reduction in the SNB angle and mandibular length with the improvement of profile on lateral cephalogram.

Dental changes — Midline diastema was corrected, class I molar and canine relation was achieved, optimal overbite and overjet were achieved and all spaces were closed.

Radiographic changes — Cephalometrically, a significant decrease in the SNB angle from - 86 degrees to 80 degrees was seen and improvement in ANB angle was seen at the end of the treatment and 1-year follow-up results. WITS analysis showed a significant improvement from -4mm to 2mm and it remained constant even 1 year post treatment. Main finding was a change in the effective mandibular length from 129 mm to 121 mm. Growth improvement was seen in the Y axis value which changed from 62 degree to 69 degrees. Upper incisor proclination changed from 24mm to 16 mm and from 52.5 degree to 32 degree.Lower incisor proclination changed from 18mm to 8 mm and from 42 degree to 27 degree.Interincisal angle changed from 98 degrees to 128degrees, thus significantly decreasing the proclination and the increased lower anterior facial height reduced from 80 mm to 78mm. The maxillomandibular plane angle changed from 35degree to 28degree. Cephalometrically, following changes were observed— A superimposition of the pre- and post treatment cephalometric tracings shows the decrease in proclination of upper and lower anterior teeth with a normal inter-incisal angle. The shortening of mandible due to distalization with buccal shelf implants can also be seen .Acceptable root parallelism was achieved and bone loss did not occur

Soft tissue changes — The procumbent lower lip before treatment was changed into ideal form, nasolabial angle improved, chin throat angle improved, facial profile was changed to a straight profile and the aim of achieving a pleasing smile and profile was achieved.All pretreatment objectives were met in this case. The facial appearance was improved as a result of both skeletal and dental changes and class I skeletal relationship was achieved at the end of surgical and orthodontic treatment.

POST TREATMENT EXTRA-ORAL PHOTOGRAPHS (Figure no 12,13,14,15,16)



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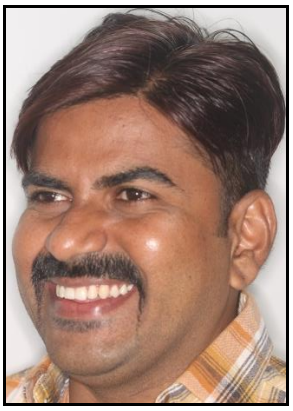
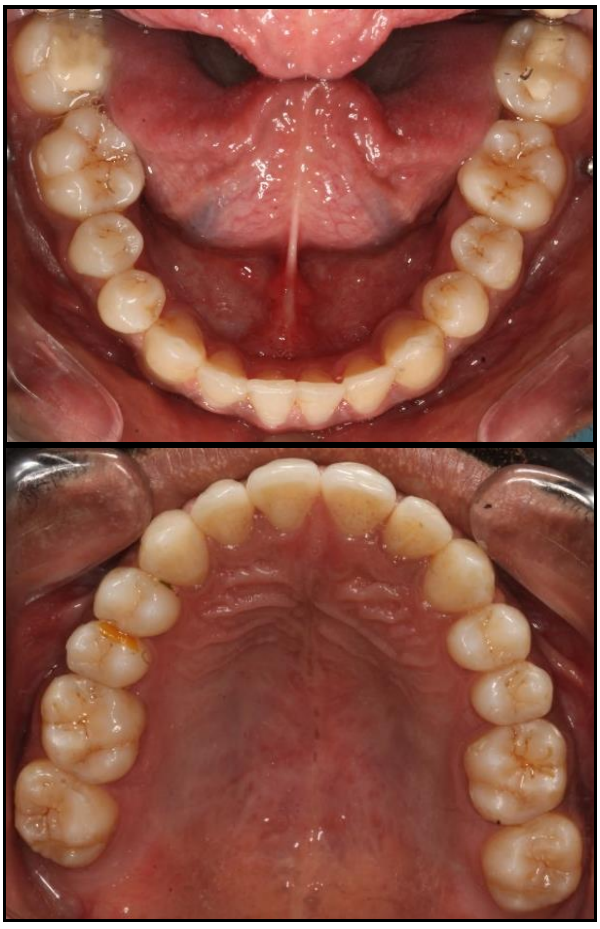
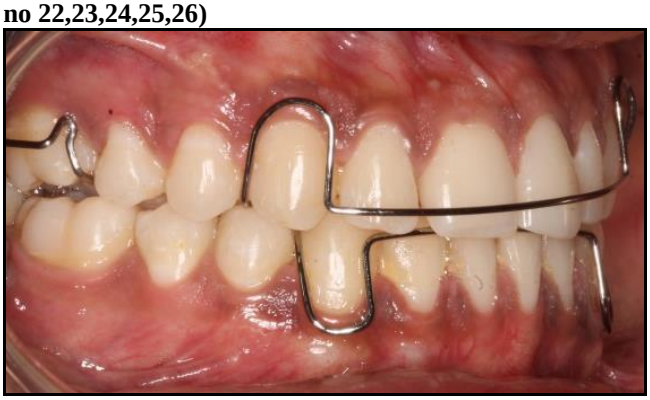
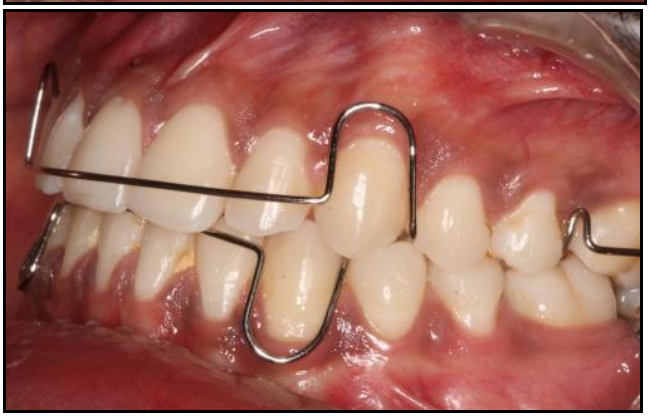


POST TREATMENT INTRA-ORAL PHOTOGRAPHS (Figure no 17,18.19,20,21)



RETENTION WITH HAWLEY'S RETAINER (Figure no 22,23,24,25,26)





CONCLUSION

Surgical–orthodontic treatment was supposedly the best option for achieving an acceptable occlusion and a good esthetic

result in such cases, but this case was managed by a non-surgical minimally invasive approach merely with the help of bone screws.It is very imperative that Class III discrepancy be diagnosed and evaluated according to its etiology and treatment be done with appropriately without compromising the patients' airway. Keeping this in mind the lower airway patency was constantly monitored throughout the process of distalization with the help of buccal shelf implants. As orthodontics progresses to develop technically and wholly, we do expect that advances in diagnosis and treatment planning are inevitable.[17] It is important however to emphasize that good retention does contribute to maintaining the appropriate occlusion that is achieved with bone screws, ensuring and guaranteeing the occlusal stability, which will surely have positive repercussions on the final tissue stability.

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