Case Report

International Journal of Dental and Health Sciences
Volume 04, Issue 02

TREATMENT OF CLASS III SUBDIVISION, BIMAXILLARY DENTOALVEOLAR PROTRUSION WITH ABNORMALLY SHAPED AND ROTATED MAXILLARY MOLAR USING "D" TPA: A CASE REPORT

Dhaval Ranjitbhai Lekhadia[1]

1 Private practitioner in Unique Hospital, MDS in Orthodontics and Dentofacial Orthopedics, Surat, Gujarat.

ABSTRACT:

This case report describes the orthodontic treatment of a 21-year-old male patient who presented with Convex profile, proclined upper and lower incisors, generalised spacing in upper and lower arches, Katz class III premolar relation unilaterally, class III canine relation unilaterally with decreased overjet and overbite. A "D" Transpalatal arch and MBT system was used for the treatment. This case report describes the construction and use of "D" TPA for effective unilateral correction of rotated maxillary molar, correction of unilateral Class III molar relation and reinforcement of contra lateral molar anchorage simultaneously in a class III subdivision case. One elastic swallow exercise was recommended to stop mild tongue thrust habit and train the tongue with correct posture. All four first premolar extractions were advocated since patient had a convex profile and protrusive lips which was the chief complaint of patient. Unilateral molar and canine relation correction was achieved by protracting the entire maxillary right dental segment using "D" TPA. Total treatment time was 18 months. Abnormally shaped molar was restored with a PFM crown. Aesthetic and functional goals were achieved satisfactorily at the end of treatment.

Keywords: "D" TPA, Unilateral Class III, Unilateral protraction, Abnormally shaped molar, PFM crown

INTRODUCTION

Mesial molar relationships can arise due to the distopalatal/mesiobuccal rotation of maxillary molars. It is proven that an ideal Class I intercuspation can be achieved with the opposing molar and a Class II or a Class III relationship can be corrected by molar derotation.[1] A gain of 1 to 2 mm of arch length per side may be achieved following derotations.[2] Abnormal size, shape, or position of teeth can also lead to malocclusions that are not the result of other forces (e.g., muscular imbalances, excessive frenum tissue, etc.).[3] Due to over retained deciduous second molars in maxilla, the permanent first molars and premolars erupt in a distal position resulting in a Class III molar, premolar and canine relationship .Goshgarian [4] introduced the transpalatal arch (TPA) for molar derotation to the orthodontic literature in 1972. TPA has proved to be an effective device to stabilize, rotate and distalize the molars.[4] Kele's TPA was introduced in 2003 for effective, precise and rapid Molar Derotation.[1] There are very few studies to evaluate the effectiveness of a TPA in a Class III case.

*Corresponding Author Address: Dr. Dhaval Lekhadia Email: drdhavallekhadia@gmail.com

Investigators have assessed the shape of maxillary first molars and examined the arch length gain with derotation.[5-7] An abnormally shaped maxillary first molar can also have an effect on arch length and functional occlusion.[2]

In a large number of Class II subdivision cases, the maxillary dental midline will be coincidental, or present a minimal deviation to the clinical facial midline while the mandibular dental midline will be displaced towards the Class II side, in faces with subclinical asymmetry [8-13]. In such cases, best treatment options would be to extract two maxillary premolars and one mandibular premolar on the Class I side.[8-13] Correction of dental midline deviation in this treatment approach is facilitated since it is obtained concurrently with space closure of the mandibular arch. Although similar studies have not been conducted in dental Class III subdivision cases, an approach of using a "D" TPA for early and rapid derotation and protraction of molars unilaterally using light forces have been exemplified in the following case.

"D" TPA construction:

Maxillary first molars were banded with pre soldered MBT molar tubes buccaly and a lingual sheath was welded lingually in the middle third of the molar crowns with the mesial end of the tube in line with the mesiolingual cusps of maxillary molars. The lingual attachment is designed to accommodate 0.027x0.027-inch wires. The D TPA is a modification of Keles TPA [1] which includes use of 0.021x0.025" Beta titanium wire instead of 0.032x0.032" TMA wire as in Keles TPA [1] and a U loop. It is fabricated by incorporating helices at the lingual attachment opening (Fig.1). This allows for application of lighter forces for derotation and protraction of molar and avoid hyalinization phase. Use of undersized wire would also result in play of wire in the lingual attachment and allow accommodating any errors in TPA fabrication. A U loop was fabricated in the palatal area to allow adjustments in width and anteroposterior adjustment of TPA (Fig.2). Anteroposterior adjustment is required for anteroposterior molar movement unilaterally and contra lateral anchorage reinforcement. Anteroposterior adjustments can be done by placing a bend on the U loop of the D TPA. Location of the bend, right or left arm, depends on the treatment goals. D TPA is constructed with a passive configuration first (Fig. 3) followed by banding of molars. This is followed by activation of TPA. The method of activation is described in (Fig. 4). Two lines are drawn on a piece of white paper along the terminal ends of D TPA (Fig. 4). Additional line is drawn with a red pen (Fig. 5) with 45-60 degree angle (based on severity of rotation) unilaterally on Class III side passing through the distal end of the helix. 45-60 degree activation is required as a beta titanium wire is used and a play exist. Therefore overactivation of D TPA is can be done unlike the conventional TPA. The biomechanics of the D TPA is demonstrated in (Fig. 6). A moment is generated on the Class III side maxillary

molar and a distal force is generated on the class I side maxillary molar. This results in reciprocal forces on both side with distal force on left molar and a mesial force on right molar resulting in protraction of right molar along with light (2 ounces) class III elastics and anchorage reinforcement of left maxillary molar.

Unilateral activation of a TPA, as described by Cetlin and Ten Hoeve [14] would generate distal force on one side and rotation on the other side. After the correction of rotation of the molar on one side, Cetlin and Ten Hoeve recommend subsequent activation to rotate the molar on the other side a few months later. This would extend the treatment duration and generate unwanted distal forces. Thus a D TPA can be used to bring about simultaneous rotation, protraction, anchorage reinforcement and vertical control of molars saving time unlike the conventional TPA.

CASE DETAIL:

The present case report showcases the treatment of a class III subdivision case using "D" TPA and conventional friction mechanics.

Diagnosis and Treatment plan:

A 21 year old adult male patient in the permanent dentition presented with the chief complaint of forwardly placed anterior teeth with spacing in between them. Upon extraoral examination, patient had a convex profile, average growth pattern, reduced nasolabial angle, protrusive lips, upper midline shifted to the right by 1mm and lower midine shifted to the left by 1mm, non consonant smile (Fig. 7-12). He was also diagnosed with mild tongue thrust habit. Upon intraoral examination, he had proclined anteriors, generalized spacing in upper and lower arch, abnormally shaped molar on right side, Angle's Class III molar relation, Katz Class III premolar relation and class III canine relation on the right side and scissor bite i.r.t 16, the overjet was 1mm and overbite was 10 (Fig. 13-17). The finding were confirmed with study models (Fig. 18-22) and pretreatment radiaographs (Fig. 23,24). Cephalometric analysis indicated a Class I skeletal pattern, average growth pattern and Proclined upper and lower incisor. (Table 1)

Following a comprehensive clinical and data-base analysis, we devised a treatment plan involving extraction approach- extracting all four first premolars to retract the incisors for a pleasing profile and normal lip profile.

Treatment Alternatives:

1. Symmetric extraction of 14,24,34,44.
2. Asymmetric extraction of 15,24,34,44.
3. Extraction of 16 (abnormally shaped molar), 24,34,44.

First treatment option was selected because extraction of all four first premolars would help solve the chief complaint of the patient i.e. proclined anteriors since it is close to the extraction site. Second option would

help us correct the molar relation quickely but we would be left with little space for retracting the right anterior segment. This would not help us solve the chief complaint of the patient entirely. Third treatment option was discarded as we would be left with little anchorage for en masse retraction of upper right anterior segment. Also, we would finish the case in a class III relation on right side and difficulty in correcting midline discrepancy and closing the residual extraction space by protracting the second molar.

Treatment Progress:

An MBT system with 0.022" slot was used. Initial levelling and alignment was carried out in upper and lower arches using 0.016" Heat activated NiTi wires (Fig. 25-29). Activated D TPA was placed in the strap up phase to start correction from the initial levelling phase (Fig.28). A couple is generated on 16 by forces acting from D TPA and NiTi archwire in the buccal tube (Fig. 28). Light forces ensures rapid correction of rotation. Myofunctional exercise was advised for the correction of mild tongue thrust habit. After the correction of rotation, a 0.019x0.025" heat activated NiTi wire was placed in upper and lower arches. This was followed by a 0.019x0.025" SS wire with crimpale hooks distal to lateral incisor brackets in upper and lower arches.

Space closure was done on 0.019x0.025" stainless steel wires in upper and lower arches using active tie backs (Fig. 30,31). Unilateral light two ounce class III elastics were given from upper right first molar to the crimpable hooks on the lower SS archwire. Thus a total of 6 ounce of force acts on right maxillary molar (2 ounces from class III elastics,2 ounces from D TPA and 2 ounces from active tie backs) which is ideally needed to protract the molars and premolar. A unilateral class III elastics also helps us correcting the midline discrepancy. Use of unilateral elastics for correction of midline discrepancy has been described in the literature. Also light forces of class III two ounce elastics will not have an adverse effect on the vertical control of the arch. Vertical component of class III elastics was also counteracted by the D TPA in upper arch and by the reverse curve 0.019x0.025" SS wire in the lower arch.

At the end of space closure, a Class I canine and premolar relation was achieved bilaterally (Fig. 32-36). Due to the abnormally shaped right molar an ideal cusp to fossa relation with the opposite molar was not achieved (Fig. 32). To increase the functional efficiency, a PFM crown was planned in relation to 16. The orthodontic band on 16 and D TPA were removed before finishing stage for the fabrication and cementation of PFM crown (Fig. 37). Since there was a high chance of rotation relapse, the PFM crown was fabricated and cemented within 24 hours (Fig. 37) to prevent relapse of derotated abnormally shaped 16. Bite settling was done after the placement of PFM crown in 16. This allows for any adjustment required to achieve a cusp to fossa relation after the PFM crown is placed.

16 and 17 were not included in the finishing phase with a light 0.014" continuous NiTi wire in lower arch and a continuous 0.014 inch HANT wire in upper arch involving left molars and excluding right molars. Maxillary right premolars were included in the finishing phase. Short class III elastics were used on the right side and Short class II elastics were place on the left side.

At the end of treatment, a class I molar relationship, Katz class I premolar relation was achieved bilaterally along with bilateral class I canine relation. Overjet was 2 mm and overbite was 2 mm and midlines were coincident at the end of the treatment (Fig. 38-42). An aesthetic, stable and functional occlusion was achieved at the end of the treatment. A consonant smile arc, pleasing soft tissue profile and reduced lip protrusion were achieved at the end of treatment (Fig. 43-49). Upper incisors appear well within the lip line as viewed on lateral smiling profile photographs (Fig. 49)

The post-operative orthopantogram reveals parallel roots without any significant root resorption (Fig.50) and post-operative lateral cephalogram reveals reduced interincisal angle and pleasing profile at the end of the treatment (Fig. 51). The findings were confirmed from post-treatment study models (Fig. 52-56)

DISCUSSION:

It can be concluded that unilateral distopalatal/mesiobuccal rotated maxillary molars can be derotated effectively in 2 to 3 months without reciprocal effects on the opposite side. From a biomechanic point of view, the method described above has several advantages. The advantages as compared to the conventional TPA includes simultaneous correction of rotated molars, vertical control of molars bilaterally, unilateral molar protraction, unilateral anchorage reinforcement on contra lateral side. Other additional advantage includes prevention of canting of occlusal plane due to unilateral class III elastics. Some investigators prefer a soldered rather than removable type of TPA.[15] Although repeated activation of D TPA was not required in the present case, subsequent activation and repeated cementation may be required to obtain the desired results in severe rotations. Thus D TPA can be soldered to the molar bands if required. In severe cases it is always preferable to use a removable form of D TPA. Use of beta-titanium alloy wire for fabrication of D TPA allows for application of lighter forces. In contrast, the traditional TPA uses a round stainless steel wire. The other advantage of beta-titanium alloy wire is that it allows constant and long-lasting light force, without any plastic deformation. Although Literature exists for the treatment of class III subdivision case,[16,17] none of them describes the use of a TPA for effective treatment of a class III subdivision case. Therefore, a D TPA was developed for the treatment of Class III subdivision malocclusion which would save time and have a better control over the maxillary molars. The

cephalometric superimpositions revealed significant profile changes with retraction of upper and lower incisors (Fig. 57). Clockwise rotation of mandible was not observed which can be attributed to the vertical control of maxillary molars by D TPA. Therefore, the use of D TPA in vertical growers would be beneficial. The maxillary incisors were retracted palatally. The maxillary right molar moved mesially by 4 mm. The mandibular incisors were retracted. The end treatment results showed class I molar and canine relation, ideal overjet and overbite (Fig. 38,40) and competent lips (Fig. 43). The post-operative cephalometric values reveal mild restriction in point A of maxilla, maintaining of the mandibular plane angle, decreased interincisal angle, decreased protrusion of lips (Table 1). Comparing the pre-treatment extraoral photographs (Fig.7-12) with post-treatment extraoral photographs (Fig. 43-48), a significant improvement was seen in smile line, smile arc, lip competency and profile. A PFM crown in 16 increased the area of occlusal table and therefore the chewing efficiency. A well balanced functional occlusion was obtained at the end of the treatment which is necessary for the stability of the results achieved by orthodontic treatment.

CLINICAL SIGNIFICANCE:

Use of D TPA in the treatment of class III subdivision malocclusion proves to be an efficient treatment mechanic. Unlike the traditional approach of treating such cases with headgear, excessive use of heavy class III elastics or use of conventional TPA, using a D TPA minimizes treatment time and can be used for effective and efficient treatment of class III subdivision malocclusion. Present case report is an evidence of such a technique and encourages the further modification of D TPA for treating different types of malocclusion in the future.

CONCLUSION:

Treatment of class III subdivision malocclusion with bimaxillary dentoalveolar protrusion and abnormally shaped and rotated maxillary molar with a D TPA proves to be an efficient and effective treatment protocol. It applies light forces as it is made from a beta titanium alloy wire. And a play of the D TPA in the lingual attachment ensures space for errors in the fabrication of D TPA making it easy to fabricate a D TPA. Also further modification of D TPA for treating other forms of malocclusion would open up new possibilities for research.

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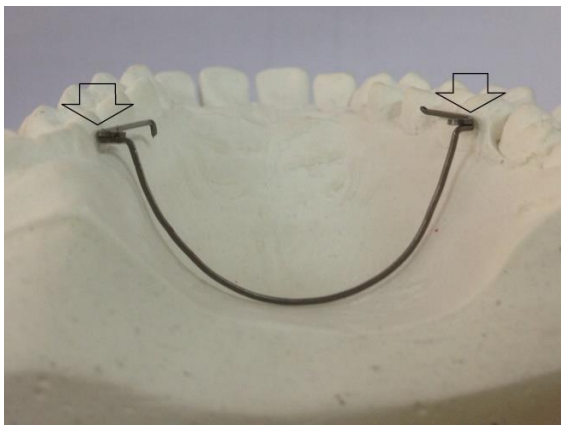
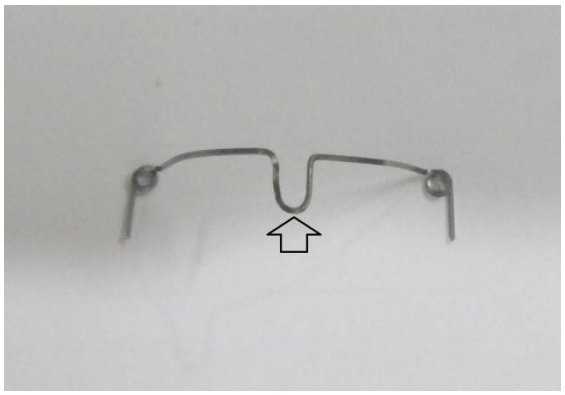
FIGURES:



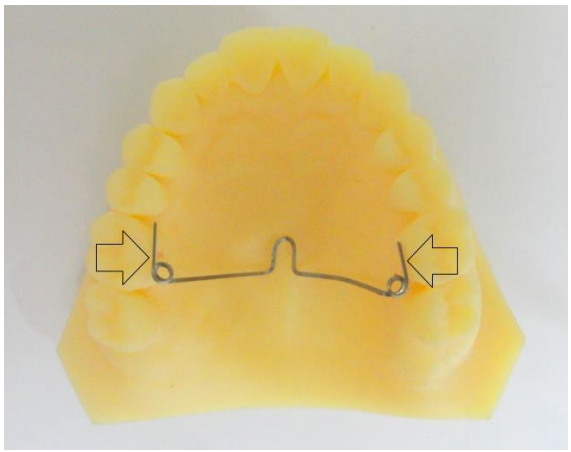
Incorporating Helices At The Lingual Attachment Opening

Method of Activation of D TPA

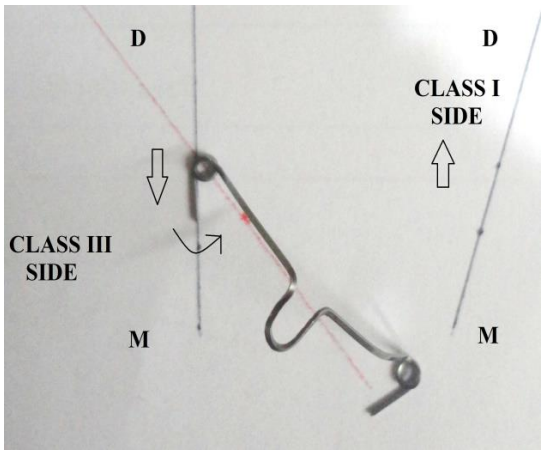


U loop in the Palatal area

Additional line is drawn with a red pen to determine the amount of activation



Passive Configuration of D TPA



Biomechanics of the D TPA for the present case

Pre-treatment extraoral frontal view

Pre -treatment extraoral oblique smile view

Pre -treatment extraoral frontal smile view

Pre -treatment extraoral right lateral profile view

Pre -treatment extraoral oblique view

Pre -treatment extraoral left lateral profile view

Pre-treatment intraoral right lateral view

Pre-treatment intraoral mandibular occlusal view

Pre-treatment intraoral frontal view

Pre-treatment study model right lateral view

Pre-treatment intraoral left lateral view

Pre-treatment study model left lateral view

Pre-treatment intraoral maxillary occlusal view

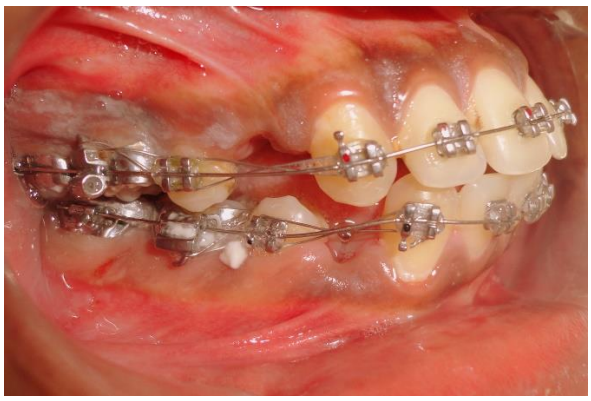
Pre-treatment study model frontal view

Pre-treatment study model maxillary occlusal view

Pre-treatment study model mandibular occlusal view

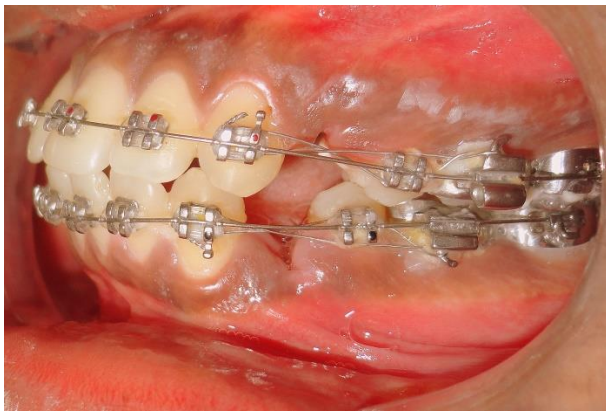
Pre-treatment OPG

Pre-treatment lateral cephalogram

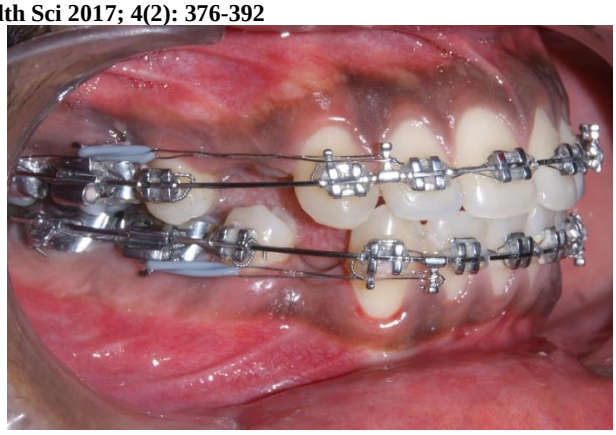


Initial levelling and alignment with 0.016" HANT wire right lateral view

Initial levelling and alignment with 0.016" HANT wire frontal view

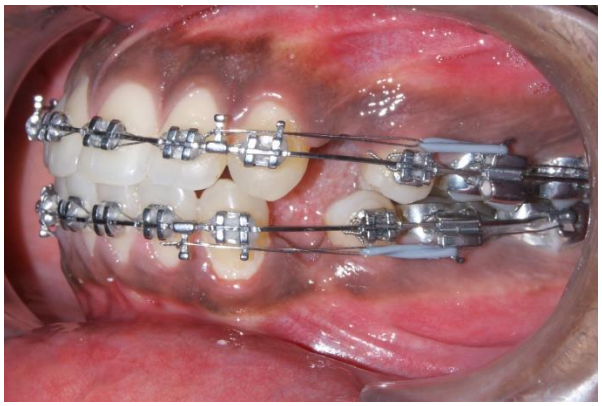


Initial levelling and alignment with 0.016" HANT wire left lateral view



Retraction using active tiebacks right lateral view

Activated D TPA in place, Initial levelling and alignment maxillary occlusal view



Retraction using active tiebacks left lateral view

Initial levelling and alignment mandibular occlusal view

End of space closure- right lateral view

End of space closure- frontal view

End of space closure- mandibular occlusal view

End of space closure- left lateral view

Removing orthodontic band of 16 for fabrication and cementation of PFM crown

End of space closure- maxillary occlusal view

Post-treatment intraoral left lateral view

Post-treatment intraoral maxillary occlusal view

Post-treatment intraoral left lateral vi ew

Post-treatment intraoral mandibular occlusal view

Post -treatment extraoral frontal smile view

Post-treatment intraoral frontal view

Post-treatment extraoral frontal view

Post -treatment extraoral right lateral profile view

Post -treatment extraoral oblique view

Post -treatment extraoral left lateral profile view

Post -treatment extraoral oblique smile view w

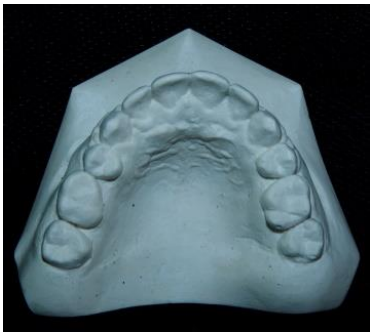
Post -treatment extraoral right lateral smile view

Post-treatment OPG

Post -treatment study model frontal view

Post -treatment study model left lateral view

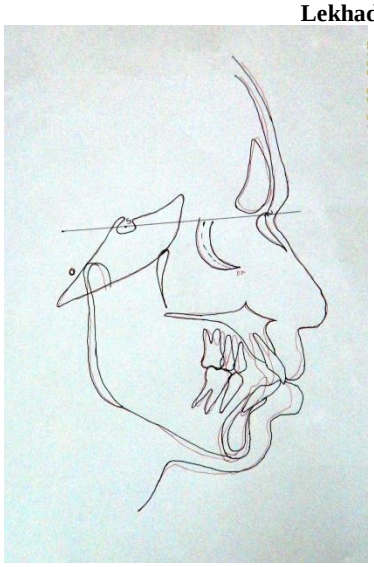
Post-treatment lateral cephalogram



Post -treatment study model maxillary occlusal view

Post-treatment study model right lateral view

Post -treatment study model mandibular occlusal view



Pre-post lateral cephalogram superimposition

TABLE :

	Pre-Treatment	Post Treatment
SNA	83°	82°
SNB	79°	79°
ANB	4°	3°
Ang.of convexity	7°	5°
Wits AO/BO	0 mm	0 mm
FMA	28°	28°
SN-GO-GN	32°	31°
Y AXIS	62°	62°
Jarabak's Ratio	64.8%	65.8%
LAFH	72 mm	73 mm
Gonial angle	124°	125°
Base plane ang.	24°	24°
U1 to NA angle	32°	24°
U1 to NA linear	10mm	4mm
U1 to FH	121°	113°
U1 to SN	115°	108°
L1 to NB angle	46°	26°
L1 to NB linear	14mm	6mm
Interincisal angle	92°	127°
Nasolabial angle	84°	96°
'S' line to upper lip	4 mm	1.5 mm
'S' line to lower lip	8 mm	3 mm
Lower lip to E-line	6 mm	2 mm