

Application of a Customized Transparent Graphed Jig (CTGJ) to Evaluate Skeleto-Dental Asymmetry of Maxillary and Mandibular Arch: A Case Report.

Abstract:

Correcting Class II subdivision malocclusions characterized by dentoalveolar asymmetry has long been a challenge for clinicians. In Class II subdivision the molar occlusion is Class II on one side, and Class I on the other. Before planning orthodontic treatment to correct subdivision problems, the location of the asymmetry must be identified. Is it in the maxillary arch, the mandibular arch, or a combination? Janson observed slightly better treatment results in asymmetric extraction of three premolars compared with extraction of four. The asymmetric-extraction choice tends to be more successful in obtaining midline correction with reduced incisor retraction. This article shows a use of a Customized Transparent Graphed Jig (CTGJ) to measure skeleton-dental asymmetry of maxillary and mandibular arch. In this case report Class II subdivision malocclusion treated by three premolar extraction diagnosed using customized transparent graphed jig is discussed.

Keywords: Class II sub division ; graphed jig ; midline shift ; mini screws ; anterior intrusion ; deep bite ; anterior crowding.

Introduction:

Correcting Class II subdivision malocclusions characterized by dentoalveolar asymmetry has long been a challenge for clinicians. In Class II subdivision the molar occlusion is Class II on one side, and Class I on the other. Before planning orthodontic treatment to correct subdivision problems, the location of the asymmetry must be identified. Is it in the maxillary arch, the mandibular arch, or a combination? Is there a skeletal component, a disk displacement, or a pathological condition of the TMJ with dentoalveolar asymmetries? Some Class II subdivision problems are created by distal positioning of the mandibular first molar or mesial positioning of the maxillary first molar on the Class II side.[1-4]

Asymmetry of arch form may also be present even if the face looks symmetric. This condition will be present especially in subdivision cases. In other words finding symmetry related to basal jaw structures, unilateral Class II malocclusion must be attributed to asymmetrical position of one of the dental arches upon its skeletal base. Accurately trimmed dental casts are a necessity if the asymmetry is to be most easily recognized.[5-6]

Janson observed slightly better treatment results in asymmetric extraction of 3 premolars compared with extraction of four. The asymmetric-extraction choice tends to be more successful in obtaining midline correction with reduced incisor retraction.[7, 8, 9]

Asymmetric extraction of 3 premolars will produce Class I canine relationship bilaterally and Class II subdivision molar relationships, along with coincidence of the maxillary and mandibular dental midlines to each other and in relation to the mid-sagittal plane.[8-11]

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Received : 15 June, 2021 **Published :** 31 August, 2021

How to cite this article: Mishra, S. (2021). Application of a Customized Transparent Graphed Jig (CTGJ) to evaluate skeleto-dental asymmetry of maxillary and mandibular arch- A case report. UNIVERSITY JOURNAL OF DENTAL SCIENCES, 7(2):. 103-108

Access this article online

Website:
www.ujds.in

DOI:
<https://doi.org/10.21276/ujds.2021.7.2.21>

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This article shows a use of a Customized Transparent Graphed Jig (CTGJ) to measure skeleton-dental asymmetry of maxillary and mandibular arch which is helpful in analysis of relative symmetry of molar position on subdivision side in relation to molar of contralateral side, which helps the clinician to diagnose that subdivision created by maxillary molar or by mandibular molar. A case report of Class II subdivision malocclusion treated by three premolar extraction after diagnosis of customized transparent graphed jig was discussed in this article.

Design and Fabrication:

A 2 mm thick transparent polyvinyl sheet used for fabrication of “Customized Transparent Graphed Jig (CTGJ)”. Thickness of sheet should be 2 mm or more to provide sufficient rigidity during assessment of relative arch symmetry. Dimension of sheet was 12 mm X 18 mm (height and width). A 10 mm X 16 mm sized graph printed on transparent sheet. A thick black vertical line was drawn from the center of the graph that is “ Mid reference line” and six horizontal thick black lines were drawn. Upper 5 horizontal lines represent as “ Horizontal reference lines” and last sixth horizontal line can be referred as “ Model base line” (Figure 1).

The mid reference line is used for coinciding the upper arch with mid palatal raphe, the horizontal reference lines are used for the assessment of first molar and canine position while the model base line is used for coinciding the lower border of model or cast.

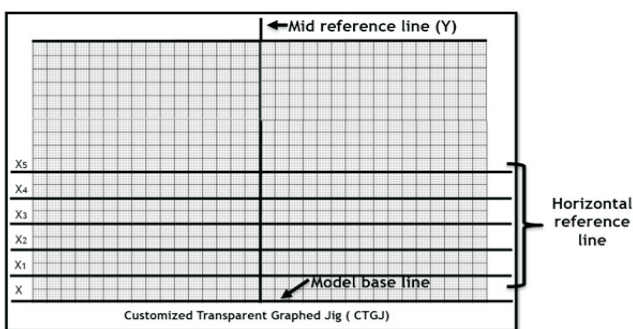


Figure 1. Customized Transparent Graphed Jig

Method of application:

Before assessment of the relative symmetry of the maxillary and mandibular arch, place the maxillary or mandibular cast on a flat surface then place the CTGJ on the cast and adjust it so model base line should be parallel with lower border of cast

while mid reference line coincides with the mid palatal raphe/lingual frenum (maxillary/mandibular arch).

An ideal maxillary and mandibular study model used for assessment of relative symmetry is shown in Figure 2. The fifth horizontal reference line passes through canine cusp tip and third horizontal reference line passes through mesio-buccal cusp tip of first molar.



Figure 2. Application of Customized Transparent Graphed Jig on Ideal maxillary and mandibular study model

Case Report:

A 20 Year old male patient presented to our department with the chief complaint of crowding and forward placement of his upper and lower front teeth.

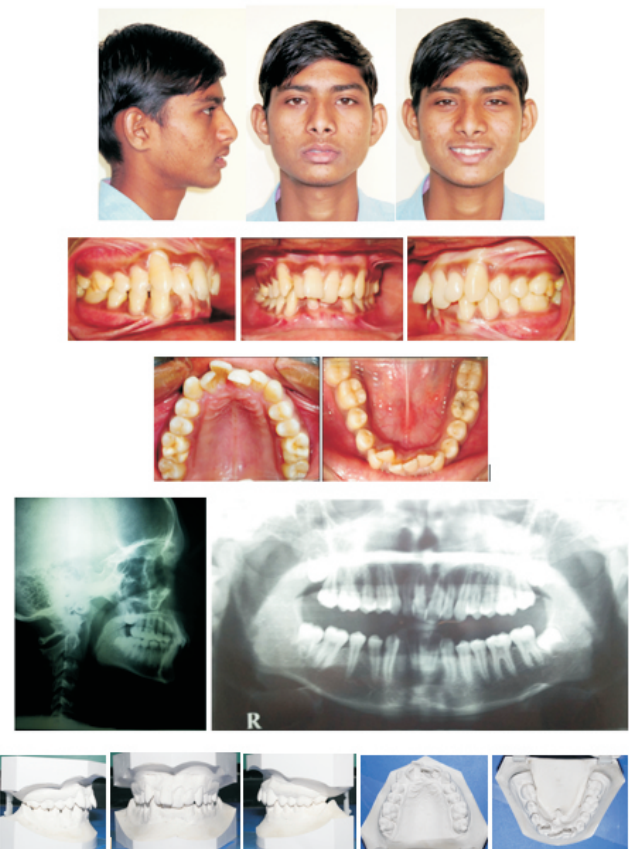


Figure 3. Pre-treatment records

Diagnosis:

Clinical examination showed a convex profile, mild posterior divergence, competent lips, deep mentolabial sulcus and Class I canine relationship on left side and end on canine relation on right side. He had Class II molar relation on right side and Class I molar relation on left side. The upper and lower dental midline were coinciding to each other but dental midline was found to be shifted 2 mm towards right side with respect to the facial midlines (Figure 3).

The oral hygiene status was average. Temporomandibular joint (TMJ) assessment revealed no history of pain or clicking on maximum opening and closure. The right and left excursive movements were normal. Maximum mouth opening was 37 mm.

Panoramic radiographic examination showed that all teeth were present and revealed optimum bone support for orthodontic mechanotherapy (Figure 3). TMJ space revealed normal size, shape and position of the condylar heads.

On cephalometric assessment the pre-treatment ANB angle was found to be 5° and MPA was 25° pointing to a Class II skeletal base and a hypodivergent growth pattern (Table 1). As clinical examination already revealed proclined upper incisors hence the 1/NA was 38° and 11 mm. IMPA was slightly increased and 1/NB was found to be in normal range i.e. 97° and 20° respectively.

TABLE 1: Cephalometric Readings of The Patient's Lateral Cephalograms Tracing.

	CEPHALOMETRIC DATA		
	NORM	PRE TREATMENT	POST TREATMENT
SNA	82°	82°	82°
SNB	80°	77°	79°
ANB	2°	5°	3°
MPA	32°	25°	27°
1/NA	22°	38°	27°
1-NA	4.0mm	11 mm	3 mm
1/NB	25°	20°	21°
1-NB	4.0mm	3 mm	3 mm
IMPA	90°	97°	102°
1/1	131°	118°	126°

Customized transparent graphed jig assessment showed that maxillary arch and mandibular arch were relatively asymmetrical. Left maxillary cusp tip of canine is 2 mm behind to the fifth horizontal reference line in respect to right maxillary canine in CTGJ (red circle in figure 4). Right and left maxillary first molar are coinciding to each other to the

third horizontal reference line in CTGJ (yellow rectangle in figure 4). Upper midline was found to be shifted 2 mm towards right side with respect to the mid reference line (Figure 4). Left mandibular cusp tip of canine is 3 mm ahead to the fifth horizontal reference line in respect to right mandibular canine in CTGJ (red circle in figure 4). Left mandibular first molar is 9mm ahead to the third horizontal reference line in respect to right mandibular first molar in CTGJ (yellow rectangle in figure 4) which has remarkable effect on subdivision. So mesial positioning of left mandibular first molar is responsible for development of subdivision in this case. The lower midline was found to be shifted 2 mm towards right side with respect to the mid reference line (Figure 4).

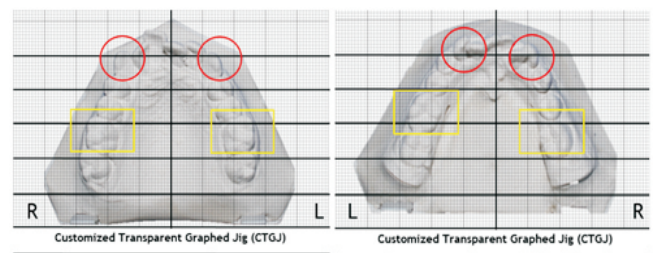


Figure 4. Pre- treatment assessment of relative symmetry of maxillary and mandibular arch by Customized Transparent Graphed Jig

Treatment Plan and Progress:

Treatment goals were to correct the patient's skeletal and dental relationships and improve the soft-tissue balance. Two treatment options were discussed. First, 14, 24, 34 and 44 followed by finishing the case in ideal Class I molar and canine relation with midline correction. Secondly, 14, 24 and 34 extraction and finishing the case in Class II subdivision molar relationship and Class I canine relationship bilaterally. In this case we opted atypical three premolars extraction followed by sliding mechanics with the help of mini-implants (Figure 5).

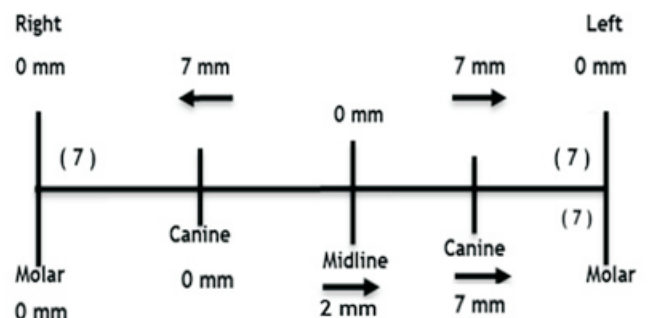


Figure 5. Dental VTO (Anticipated Treatment Change in Maxillary and Mandibular Arch)

Full fixed Preadjusted Edgewise appliance MBT of 0.022" (3M Unitek TM Gemini Metal Brackets) prescription was placed to level and align both arches. Patient was referred for extraction of 14, 24 and 34 for correction of proclination of anteriors before commencing levelling and aligning. Banding and bonding was done along with Trans Palatal Arch (TPA). Upper second molars were also banded. Levelling aligning was commenced on 0.012" NiTi (3M Unitek Nitinol Super elastic wire) and gradually reached a thicker gauge wire of 0.017" X 0.025" SS in the upper and lower arch in a period of eight months.

After leveling and aligning 0.019" X 0.025" stainless steel arch wire was used for retraction. S.K. surgical Titanium Mini- implant (size - 1.5 X 8 mm) placed at mucogingival junction in between root of second premolar and first molar in upper arch on both side for retraction. 7 mm power arm placed on archwire between lateral incisor and canine and Ni-Ti closed coil used for space closure and midline correction. Spee was given in upper archwire to maintain torque during retraction (Figure6).



Figure 6. Mid treatment records

For intrusion of lower incisor two 1.5 X 6 mm sized S.K. surgical Titanium mini-implant placed bilaterally in between lateral incisor and canine in lower arch (Figure 7 and 9).

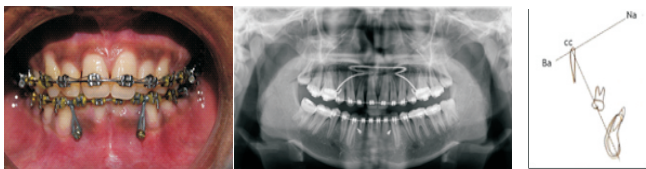


Figure 7. Intrusion of lower incisors by mini-implants

After 19 months of active treatment, class II subdivision molar relationship, ideal overjet and overbite with pleasing soft tissue profile was achieved (Figure 7). Following this, debonding was done and post treatment records were taken. Fixed bonded lingual retainer given in upper and lower arch for retention.

Results:

The post treatment facial photographs showed marked improvement in smile and facial profile. Maxillary anterior teeth protrusion was corrected, and a Class II molar relationship was maintained on right side and Class I molar

relation in left side with Class I canine relationship bilaterally. The over jet and overbite was corrected. The upper incisors to NA plane had decreased from 38° to 27° and the lower incisors to NB plane increased from 20° to 21° (Table 1). The retraction of the maxillary incisors contributed to correction of the soft tissue profile (Figure 8 and 9).



Figure 8. Post treatment records



Figure 9. Superimposition: Sella - Nasion at Nasion

Post- treatment customized transparent graphed jig assessment showed that upper and lower midlines were now coinciding with mid reference line. Fifth horizontal reference line was now passing through cusp tip of canine in mandibular arch but in maxillary arch cusp tip of right canine is not coinciding with fifth horizontal reference line in respect to left

maxillary cusp tip of canine. Right maxillary first molar is 2 mm ahead to the third horizontal reference line in respect to left maxillary first molar in CTGJ which shows anchorage loss on right side during leveling and aligning. Due to asymmetric extraction of premolar in mandibular arch for maintaining Class II subdivision molar relationship, left mandibular first molar is 4.5 mm ahead to the third horizontal reference line in respect to left mandibular first molar in CTGJ. (Figure 10).

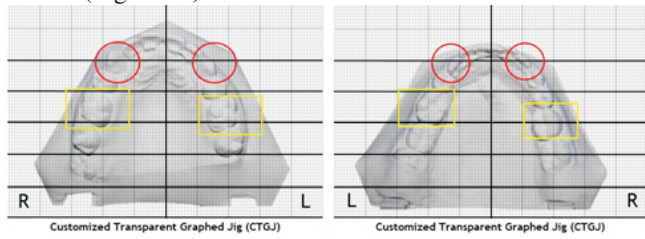


Figure 10. Post- treatment assessment of relative symmetry of maxillary and mandibular arch by Customized Transparent Graphed Jig

PAR Scoring Assessment:-

Peer assessment rating (PAR) index was assessed under heading of anterior segments (upper and lower), buccal occlusion, overjet, overbite and centre line for pre-treatment and post-treatment intraoral records. Assessment of pre-treatment of intraoral records shows that she had 22 PAR scoring points which reduced up to zero (0) PAR scoring points in post-treatment intraoral records. So change in PAR score was 22 points and percentage change in PAR score was 100% which shows “improved” orthodontic treatment results (Table 2).

CASE NUMBER	Pre-Treatment	Date	April 2016							UN-WEIGHTED TOTAL	WEIGHTED TOTAL						
PAR COMPONENTS	RIGHT							LEFT									
Upper anterior segments	3-2	2	2-1	2	1-1	2	1-2	2	2-3	1	9	X1					
Lower anterior segments	3-2	3	2-1	3	1-1	1	1-2	2	2-3	1	10	X1					
Buccal occlusion	Antero-posterior							Right	1	Left	0	1	X1				
	Transverse							Right	0	Left	0	0	X1				
	Vertical							Right	0	Left	0	0	X1				
Overjet	Positive							0	Negative							0	X6
Overbite	Overbite							2	Openbite							0	X2
Centre line	0														0	X4	
TOTAL											22						

CASE NUMBER	Post-Treatment	Date	November 2017							UN-WEIGHTED TOTAL	WEIGHTED TOTAL						
PAR COMPONENTS	RIGHT							LEFT									
Upper anterior segments	3-2	0	2-1	0	1-1	0	1-2	0	2-3	0	0	X1					
Lower anterior segments	3-2	0	2-1	0	1-1	0	1-2	0	2-3	0	0	X1					
Buccal occlusion	Antero-posterior							Right	0	Left	0	0	X1				
	Transverse							Right	0	Left	0	0	X1				
	Vertical							Right	0	Left	0	0	X1				
Overjet	Positive							0	Negative							0	X6
Overbite	Overbite							0	Openbite							0	X2
Centre line	0														0	X4	
TOTAL											0						

PAR SCORE	IMPROVEMENT		
Change in PAR score	22	Greatly improved	✓
% change in PAR score	100	Improved	
		Worse or no different	

Table 2. PAR scoring assessment of outcome

Discussion:

In this case major treatment objectives were achieved and relative symmetry was well explained to its maximum precision by the customized transparent graphed jig. The graphic representation of the asymmetry was helpful to determine and quantify the asymmetry to the tune of 0.5 mm. In this case Class II subdivision was due to mesial positioning of left mandibular first molar. Rose et al also found in his study that the mandibular first molar is responsible for development of Class II subdivision. He measured mandibular position relative to the cranium floor or to the mandibular condyle and found that the mandibular first molar are located more anteriorly on the Class I side.[12]

In most patients with Class II subdivision malocclusion, the maxillary dental midline is coincident to the mid-sagittal plane and mandibular dental midline has a minimal deviation. Correcting the interdental midline deviation with asymmetric premolar extraction (three premolar extraction) is easier, because it is achieved simultaneously with closing the extraction space in the mandibular arch. The asymmetric-extraction choice tends to be more successful in obtaining midline correction.[6, 7]

The treatment of the Class II subdivision malocclusions by extracting 2 maxillary and 1 mandibular premolars required an absolute anchorage to avoid a mesial movement of the posterior segment during the retraction of the anterior teeth. To meet this demand, sliding mechanics in combination with implant anchorage has become more and more popular throughout the world.[13]

The mandibular incisors were effectively intruded by using mini-implants as orthodontic anchorage and it doesn't has any counteractive movements in the molars during intrusion of lower incisors.[14]

Conclusion:

Diagnosis plays an important role in the treatment planning. As there is so many options are available for a clinician to treat a class II subdivision malocclusion case, it becomes the clinician's duty to opt for the best modality fitting for a specific case. Before planning orthodontic treatment to correct subdivision problems, the location of the asymmetry must be identified. This customized transparent graphed jig helps clinician to locate the relative asymmetry. This jig also helps to compare the pre and post treatment results.

Declaration of patient consent:

The author certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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