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### RESEARCH ARTICLE

#### NON- SURGICAL CORRECTION OF GUMMY SMILE AND A COMPLETE OVERBITE IN A FEMALE PATIENT WITH A CLASS II DIVISION 2 MALOCCLUSION AND A NON CONSONANT SMILE ARC BY BITE OPENING WITHOUT EXTRACTION OF PREMOLARS - A CASE REPORT

Jawale Bhushan<sup>1</sup>, Rodrigues Lishoy<sup>2</sup>, Juvvadi Shubhaker<sup>3</sup>, Patil Tushar<sup>4</sup>, Ambekar Anand<sup>5</sup> and Chaudhari Amit<sup>6</sup>

1. Professor, Dept of Orthodontics and Dentofacial Orthopedics, Sinhgad Dental College and Hospital, Sinhgad, Pune, Maharashtra, India.
2. P.G. Student, Dept of Orthodontics and Dentofacial Orthopedics, Sinhgad Dental College and Hospital, Sinhgad, Pune, Maharashtra, India.
3. Vice Principal, Professor and HOD, Dept of Orthodontics and Dentofacial Orthopedics, Balaji Dental College and Hospital, Hyderabad, Telangana, Andhra Pradesh, India.
4. Professor and H.O.D, Dept of Orthodontics and Dentofacial Orthopedics, ShriYashwanthraoChavan Dental College and Hospital, Ahmednagar, Maharashtra, India.
5. Professor, Dept of Orthodontics and Dentofacial Orthopedics, MIDSAR, Latur, Maharashtra, India.
6. Associate Professor, Dept of Periodontology and Implantology, BVP Dental College and Hospital, Pune.

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##### Key words:-

Gummy Smile, Non Surgical Correction, Complete Overbite, Non Consonant Smile Arc, Bite Opening, Class II Div 2 Malocclusion

#### Abstract

This case report evaluates the management of a Gummy smile and complete deep overbite in a 17 year old female patient with an unaesthetic smile. She showed presence of crowding in the upper and lower anterior region, however the case was treated without extraction of premolars. The complete deep bite was corrected non surgically merely by employing simple mechanics with the help of Fixed Orthodontic Mechanotherapy. Following fixed orthodontic treatment marked improvement in patient's smile, facial profile and lip competence were achieved and there was a remarkable increase in the patient's confidence and quality of life. The profile changes and treatment results were demonstrated with proper case selection and good patient cooperation with Fixed appliance therapy. This case was treated in a non surgical manner and without any need for extractions.

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#### Introduction:-

Excessive gingival display in smiling may make the smile displeasing or even repulsive. Correcting "Gummy Smile" thus becomes a prime treatment objective in response to patient demand. Assessment should therefore seek the etiology of gummy smile, as this will determine optimal treatment, which is usually orthodontic or orthodontic and surgical. Gummy smiles can be divided into several categories according to etiologic factors.<sup>1</sup> Dentoalveolar gummy smile occurs because of overeruption of the maxillary incisors relative to the upper lip. The dentogingival type, related to abnormal dental eruption, gingival hyperplasia, or lack of gingival recession is evidenced by short crown height.<sup>5</sup> A gummy smile of skeletal origin occurs because of excessive vertical height of the maxilla; this requires orthognathic surgery.<sup>3,6</sup> A short upper lip is also a frequent cause of a gummy smile.<sup>3</sup> The muscular type is caused by hyperactivity of the elevator muscles of the upper lip.<sup>7</sup> Finally, a gummy smile might be

**Corresponding Author:- Rodrigues Lishoy**

Address:- PG Student, Dept of Orthodontics and Dentofacial Orthopedics, Sinhgad Dental College and Hospital, Sinhgad, Pune, Maharashtra, India.

caused by several of these factors. This case presents the correction of a gummy smile in a 17 year old female patient with an unaesthetic smile. She had a Class II Division 2 incisor relationship and a complete deep bite. She also showed presence of crowding in the upper and lower anterior region, however the case was continued and completed without the need for extractions of premolars.

### Case Report:

#### Extra-oral examination:

A 17 year old female patient presented with the chief complaint of irregular and crowded upper and lower front teeth and also excessive show of gums on smiling. On Extraoral examination, the patient had a convex to Orthognathic facial profile, grossly symmetrical face on both sides, competent lips, deep mentolabial sulcus and an average Nasolabial Angle, a Leptoprosopic facial form, Dolicocephalic head form, Average width of nose and mouth, minimal buccal corridor space, anon consonant smile arc and slightly posterior divergence of face. The patient had no relevant prenatal, natal, postnatal history or a family history. On smiling, there was complete show of maxillary anterior teeth with show of upper gums. However, mandibular teeth were not visible on smile. The patient had a gummy smile. The patient had an unaesthetic smile arc and was very dissatisfied with her smile.

#### Pre treatment extraoral photographs:



#### Intra-oral examination:

Intraoral examination on frontal view showed presence of a complete deepbite of 7mm. On lateral view the patient showed the presence of Class II div 2 incisor relationship, an End On Class II Canine relationship on both sides and an End On Class II molar relationship Bilaterally. Patient had an overjet of 0 mm and an overbite of 7 mm. There was crowding in upper and lower anterior region with irregularly aligned teeth. The upper and lower arch shows the presence of a "V" shaped arch form and the upper incisors were retroclined indicative of a Class II division 2 malocclusion. The patient showed the presence of retained deciduous 2<sup>nd</sup> molar in the lower right quadrant and also there was congenitally missing lower right 2<sup>nd</sup> premolar.

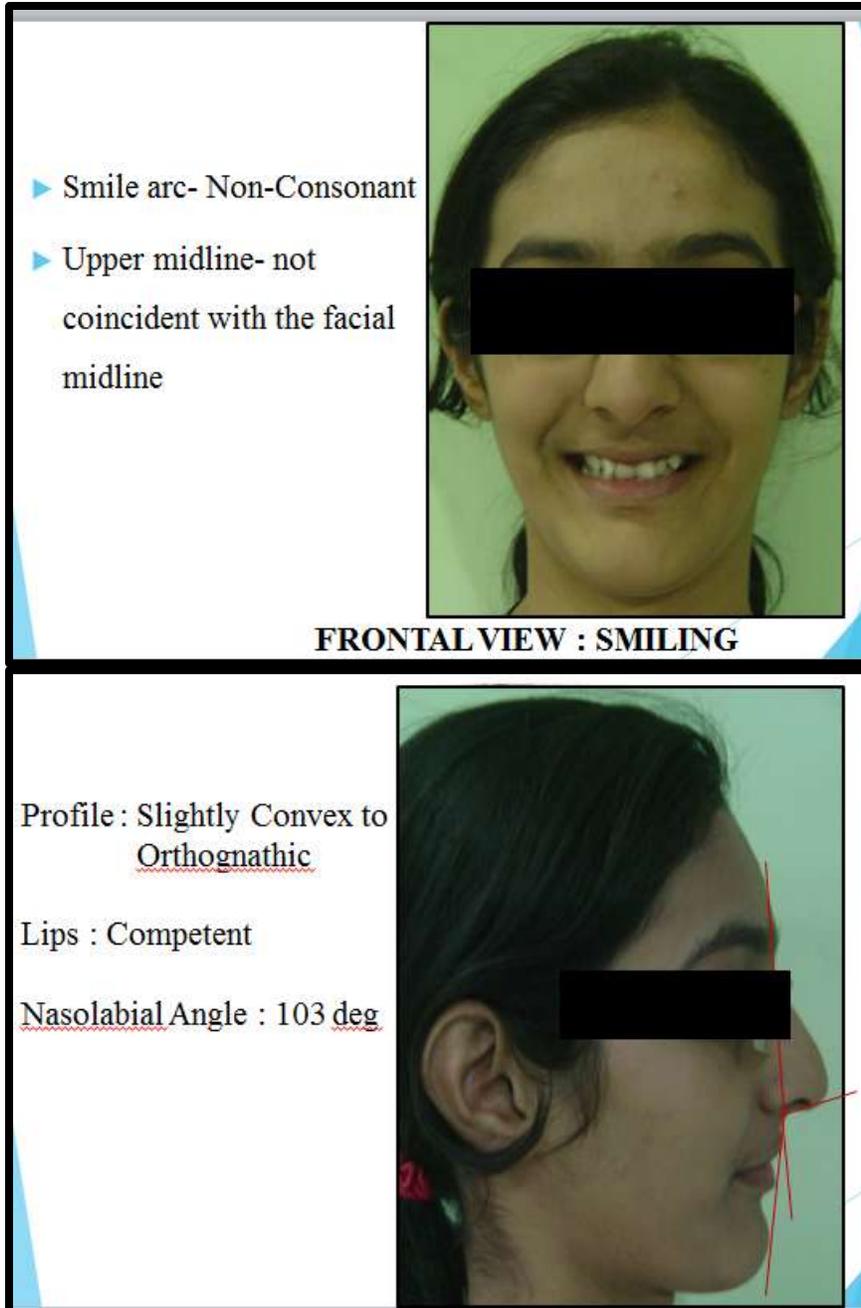
#### Pre treatment intraoral photographs:





Photographic analysis:

<p><u>EXTRA-ORAL EXAMINATION</u></p> <ul style="list-style-type: none"><li>▶ Grossly symmetrical</li><li>▶ <u>Leptoprosopic</u></li><li>▶ <u>Mesocephalic</u></li><li>▶ Average width of the nose and mouth</li><li>▶ <u>Competant lips</u></li></ul>	
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Pre treatment cephalometric readings:

<b>STEINER'S ANALYSIS</b>			
Measurement	Mean	Pre Rx	Inference
SNA	82°	82°	Average
SNB	80°	78°	Average
ANB	2°	4°	Class II skeletal pattern
Go-Gn to Sn	32°	26°	Horizontal growth pattern
U1 to NA angle	22°	13°	Retroclined max incisors
U1 to NA mm	4mm	2mm	Backwardly placed max incisors
L1 to NB angle	25°	24°	Average
L1 to NB mm	4mm	4mm	Average
Interincisal angle	130°	139°	Retroclined upper and lower anteriors
Occlusal plane - SN	14°	23°	Horizontal growth pattern
'S' Line			Protrusive upper and lower lips
U Lip	0mm	1 mm	
L Lip	0mm	1 mm	

### **TWEEDS ANALYSIS**

Measurement	Mean	Pre Rx	Inference
FMA	25°	21°	Horizontal growth pattern
FMIA	65°	61°	
IMPA	90°	99°	Proclined lower incisors

### **Wits appraisal:-**

AO ahead of BO by 1 mm indicating mild anteroposterior skeletal discrepancy

**RICKETTS ANALYSIS**

Measurement	Mean (for 9 yrs)	Pre Rx	Inference
Facial axis(Ba-Na to Pt-Gn)	90± 3.5°	93°	Average
Facial angle(N-pg to FH)	87± 3°	84°	Average
Mandibular plane angle	26± 4.5°	21°	Horizontal growth pattern
Convexity at Pt.A	2± 2mm	4 mm	Average
L1 to A - Pg	1± 2 mm	1 mm	Average
U6 to Ptv	Age + 3 yrs	17mm	
L1 inclination(1 to A-Pog)	22± 4°	27°	Average
Lower lip to E plane(Pog-Pn)	-2 ±2 mm	1 mm	Average

**MC NAMARA ANALYSIS**

Measurement	Mean	Pre Rx	Inference
N perp - A	0 -1mm	1 mm	Average
N perp to Pog	0-4 mm	4mm	Average
Facial axis angle(Ptm-Gn)-(Ba-Na)	0± 3.5°	3°	Average
Mand. Plane angle(FH-GoMe)	22 ± 4°	21°	Horizontal growth pattern
Eff. Maxillary Length(Co- A)		79 mm	Reduced
Eff. Mandibular Length(Co-Gn)		98mm	Reduced
Maxillomandibular differential		19mm	Reduced
Lower ant. Facial ht(ANS-Me)		55mm	Reduced
U1 to Pt. A	4-6 mm	6 mm	Average
L1 to A-Pog	1-3mm	1mm	Average
Nasolabial angle	102 ± 8°	102°	Average Nasolabial angle
Pharyngeal analysis U	15-20	18 mm	Adequate upper and lower
L	11-14	11 mm	airway passage

### RAKOSI JARABAK ANALYSIS

Measurement	Mean	Pre Rx	Inference
Saddle angle	123± 5°	124°	Average
Articular angle	143± 6°	148°	Average
Gonial angle	128± 7°	116°	Horizontal growth pattern
Upper gonial angle	52-55°	52°	Average
Lower gonial angle	70-75°	67°	Horizontal growth pattern
Sum of posterior angles	396± 6°	388°	Average
Mandibular plane angle	32°	21°	Horizontal growth pattern
Angle of inclination	85°	85°	Average
Basal plane angle	25°	19°	Horizontal growth pattern
Palatal plane to occlusal plane	11°	15°	Horizontal growth pattern
Occlusal plane to MP	14°	4°	Horizontal growth pattern
Post to Ant. Face ht. ratio	62-65%	68.52 %	Horizontal growth pattern
Y - axis(FH-SeGn)	66°	71°	Horizontal growth pattern
U1 - SN	102± 2°	112°	Increased
U1-Palatal plane	70±5	80°	Retroclined max incisors
L1 - MP	90± 3°	102°	Proclined man incisors

### HOLDAWAYS SOFT TISSUE ANALYSIS

Measurement	Mean	Pre Rx	Inference
Facial angle	90± 3°	85°	Average
Upper lip curvature	2-5 mm	5mm	Average
Skeletal convexity at Pt. A	2 ± 2 mm	4 mm	Average
H line angle	7 - 15°	19°	Protrusive upper lip
Nose tip to H line	12 mm	0 mm	Average
Upper sulcus depth	5 mm	5 mm	Average
Upper lip thickness	15 mm	15 mm	Average
Upper lip strain	2 mm	3mm	Increased lip strain
Lower lip to H line	-1 to +2mm	2 mm	Average
Lower sulcus depth	5 mm	5 mm	Average
Soft tissue chin thickness	10-12 mm	14mm	Increased soft tissue chin thickness

<b>DOWN'S ANALYSIS</b>			
Measurement	Mean	Pre Rx	Inference
Facial angle	87.8° (82°-95°)	85°	Average
Angle of convexity	0° (-8.5°-10°)	-9°	Average maxilla
Mandibular plane angle	21.9° (17°-28°)	21°	Average growth pattern
Y-axis	59° (53°-66°)	71°	Horizontal growth pattern
A-B plane angle	-4.6° (-9°-0°)	-4°	Average
Cant of occlusal plane	9.3° (1.5°-14°)	14°	Average
Interincisal angle	135.4 +/- 5.8	139°	Retroclined upper and lower anteriors
Incisor mandibular plane angle	1.4° (-8.2°-7°)	-8°	Average
Incisor occlusal plane angle	14.5° (3.5°-20°)	15°	Average
U1- A-Pog	2.7mm(-1-5mm)	5 mm	Average

**Pre treatment cephalometric summary:**

PARAMETERS	PRE- TREATMENT
SNA	82°
SNB	78°
ANB	4°
WITS	1mm(AO ahead of BO)
MAX. LENGTH	79mm
MAN. LENGTH	98mm
IMPA	99°
NASOLABIAL ANGLE	102°
U1 TO NA DEGREES	13°
U1 TO NA mm	2mm
L1 TO NB DEGREES	24°
L1 TO NB mm	4mm
U1/L1 ANGLE	139°
SADDLE ANGLE	124°
ARTICULAR ANGLE	148°
GONIAL ANGLE	116°
FMA	21°
Y AXIS	71°

**Diagnosis:**

This 17years old female patient was diagnosed with a Class II skeletal pattern and a Class II malocclusion with a horizontal growth pattern, retroclined upper incisors, crowding in upper and lower anterior region, rotated teeth, increased overbite and a gummy smile, scissor bite with 15 and 44, 25 and 35, protrusive upper and lower lips, retained deciduous teeth 75 and 85, and congenitally missing 45

### PROBLEM LIST

	Anteroposterior	Vertical	Transverse
<b>Dental</b>	<ul style="list-style-type: none"> <li>➤ Multiple Rotated teeth</li> <li>➤ Crowding in upper and lower anterior teeth</li> <li>➤ <u>Retroclined</u> max incisors</li> <li>➤ Retained Deciduous 75 and 85</li> <li>➤ Congenitally missing 45</li> </ul>	Increased overbite	Scissor bite with 15 and 44, 25 and 35
<b>Skeletal</b>	➤ Class II skeletal pattern	Horizontal growth pattern	
<b>Soft tissues</b>	➤ Protrusive upper and lower lips	➤ Gummy smile	

### TREATMENT OBJECTIVES

- ▶ To correct Retroclined maxillary anterior teeth
- ▶ To correct crowding in the maxillary and mandibular anterior teeth
- ▶ To correct gummy smile
- ▶ To correct increased overbite
- ▶ To correct scissor bite with 15 and 44 , 25 and 35
- ▶ To correct the multiple rotated teeth
- ▶ To achieve Angle's Class I molar relation bilaterally
- ▶ To achieve Class I Canine relation on bilaterally
- ▶ To correct the non consonant smile arc
- ▶ To achieve a pleasing smile and a pleasing profile

### PROVISIONAL TREATMENT PLAN

#### Fixed Mechanotherapy (MBT 0.022 slot)

- ▶ Banding of 16,26,36,46
- ▶ Correction of scissor bite with 15 and 44 , 25 and 35 with the help of cross elastics and bite turbos over mandibular molars
- ▶ Bonding with MBT brackets
- ▶ Initial leveling and alignment with 0.016" NiTi wires, following sequence A of MBT
- ▶ Interradicular implants between 12 and 13, 22 and 23 for opening of bite
- ▶ Use of 0.019/0.025" rectangular NiTi followed by 0.019/0.025" rectangular stainless steel wires for intrusion of maxillary teeth and retraction and closure of spaces.
- ▶ Final finishing and detailing with 0.014 round stainless steel wires
- ▶ Retention by means of Hawleys removable retainers in the upper and lower arch

#### Bolton ratio:-

Mandibular anterior excess:- 2.48 mm

Mandibular overall excess:- 0.35 mm

#### Ashley Howe's index:-

Need for extraction

#### Pont's Index :

Expansion not needed

#### Arch Perimeter Analysis :

Need for extraction of 1<sup>st</sup> premolars

#### Careys Analysis :

Need for extraction of 1<sup>st</sup> premolars

#### Chadda's Index :

Expansion not needed

#### **Model Analysis:**

##### **Treatment progress:**

The deciduous 2<sup>nd</sup> molar was first extracted. Complete bonding & banding in both maxillary and mandibular arch was done, using MBT-0.022X0.028" slot. Initially a 0.012" NiTi wire was used which was followed by 0.014, 0.016", 0.018", 0.020" NiTi archwires following sequence A of MBT. After 6 months of alignment and leveling NiTi round wires were discontinued. Crossbite was corrected with the help of cross elastics after giving bite turbos on the lower 1<sup>st</sup> molar teeth. Use of 0.019" x 0.025" rectangular NiTi with accentuated Anchor sweeps in the upper and lower stiff archwires were given for opening of bite to 1<sup>st</sup> open the bite considerably to an ideal height and then to prevent the bite deepening followed by 0.019" x 0.025" rectangular stainless steel wires for retraction and closure of spaces towards the site where the deciduous tooth was extracted and the permanent 2<sup>nd</sup> premolar was congenitally missing. A Group A anchorage was maintained in the upper arch and Group B in the lower arch. Finally light settling elastics were given with rectangular steel wires in lower arch and 0.012" light NiTi wire in upper arch for settling, finishing, detailing and proper intercuspation. The crowded dentition was unraveled and the incisor relationship changed from Class II Division 2 to Class I. The smile of the patient changed from being unaesthetic to

a more pleasing and consonant smile. The treatment changed the patients overall profile and helped her feel more confident. She was very happy and satisfied with the treatment.

**Mid treatment extraoral photographs:**



**Mid treatment intraoral photographs:**



**Post treatment extraoral photographs:**



**Post treatment intraoral photographs:****Post treatment cephalometric summary:**

PARAMETERS	POST-TREATMENT
SNA	82°
SNB	81°
ANB	1°
WITS	1mm
MAX. LENGTH	80mm
MAN. LENGTH	98mm
IMPA	92°
NASOLABIAL ANGLE	102°
U1 TO NA DEGREES	22°
U1 TO NA mm	3mm
L1 TO NB DEGREES	20°
L1 TO NB mm	2mm
U1/L1 ANGLE	133°
SADDLE ANGLE	125°
ARTICULAR ANGLE	147°
GONIAL ANGLE	117°
FMA	22°
Y AXIS	70°

**Retention with hawleys retainers:****Discussion:-**

Before the Orthodontist can determine the optimal treatment, he or she must consider the contributing factors. These include normal growth and development, tooth size discrepancies; excessive incisor vertical overlap of different causes, mesiodistal and labiolingual incisor angulation, generalized spacing and pathological conditions. A carefully developed differential diagnosis allows the practitioner to choose the most effective orthodontic and/or restorative treatment. Treatment of Class II Div 2 malocclusion and gummy smile without extractions of premolars is challenging. A well chosen individualized treatment plan, undertaken with sound biomechanical principles and appropriate control of orthodontic mechanics to execute the plan is the surest way to achieve predictable results with minimal side effects. Class II Division 2 malocclusion with crowding might have any number of a combination of the skeletal and dental components. Hence, identifying and understanding the etiology and expression of Class II Division 2 crowded malocclusion with a gummy smile and identifying differential diagnosis is helpful for its correction. The patient's chief complaint was irregular and crowded upper and lower front teeth and also excessive show of gums on smiling. The selection of orthodontic fixed appliances is dependent upon several factors which can be categorized into patient factors, such as age and compliance, and clinical factors, such as preference/familiarity and laboratory facilities. The execution of only Fixed appliance therapy appropriately resulted in an improvement in the patient's profile in this case. Alongside fixed orthodontic treatment, the retained deciduous tooth was removed and retraction was done in the area where the premolar was congenitally missing. The U1 to NA values both in degrees and in millimeters increased significantly thus changing the Class II division 2 incisor relationship to a Class I relationship. Successful results were obtained after the fixed MBT appliance therapy within a stipulated period of time. The overall treatment time was 15 months. After this active treatment phase, the profile of this 17 year old female patient improved significantly as seen in the post treatment Extra-oral photographs. Removable Hawley retainers were then delivered to the patient. The crowding was corrected and the smile arc of the patient improved drastically to being consonant and pleasant. The patient was very happy and satisfied with the results at the end of the treatment.

**Comparison of pre treatment and pre debonding cephalometric readings:**

PARAMETERS	PRE- TREATMENT	POST-TREATMENT
SNA	82°	82°
SNB	78°	81°
ANB	4°	1°
WITS	1mm(AO ahead of BO)	1mm

MAX. LENGTH	79mm	80mm
MAN. LENGTH	98mm	98mm
IMPA	99°	92°
NASOLABIAL ANGLE	102°	102°
U1 TO NA DEGREES	13°	22°
U1 TO NA mm	2mm	3mm
L1 TO NB DEGREES	24°	20°
L1 TO NB mm	4mm	2mm
U1/L1 ANGLE	139°	133°
SADDLE ANGLE	124°	125°
ARTICULAR ANGLE	148°	147°
GONIAL ANGLE	116°	117°
FMA	21°	22°
Y AXIS	71°	70°

### Conclusion:-

This case report shows how the correction of gummy smile can be managed alongside fixed orthodontic treatment without the need for extractions, thus lowering the treatment time and enhancing the profile of the patient. The planned goals set in the pretreatment plan were successfully attained. Good intercuspation of the teeth was obtained and the unaesthetic appearing Clas II division 2 incisor relationship was changed to Class I relationship. Treatment of this case included the protraction of maxillary incisors with a resultant facial profile improvement. The maxillary and mandibular teeth were found to be esthetically satisfactory in the line of occlusion with a pleasing and consonant smile arc. Near ideal overjet and normal overbite was achieved at the end of treatment. The correction of malocclusion was achieved, with a significant improvement in the patient aesthetics and self-esteem. The patient was very satisfied with the results of the treatment.

### References:-

1. Monaco A, Streni O, Marci MC, Marzo G, Gatto R, Giannoni M. Gummy smile: clinical parameters useful for diagnosis and therapeutical approach. *J Clin Pediatr Dent* 2004;29:19-25.
2. Robbins J. Differential diagnosis and treatment of excess gingival display. *Pract Periodontics Aesthet Dent* 1999;11:265-72.
3. Proffit WR, White RP Jr, Sarver DM. Contemporary treatment of dentofacial deformity. St Louis: Mosby; 2003. p. 111, 500-6.
4. Burstone CJ. Deep overbite correction by intrusion. *Am J Orthod* 1977;72:1-22.
5. Redlich M, Mazor Z, Brezniak N. Severe high Angle Class II Division 1 malocclusion with vertical maxillary excess and gummy smile: a case report. *Am J Orthod Dentofacial Orthop* 1999;116:317-20.
6. Ataoglu H, Uckan S, Karaman AI, Uyar Y. Bimaxillary orthognathicsurgery in a patient with long face: a case report. *Int J Adult Orthod Orthognath Surg* 1999;14:304-9.
7. Miskinyar SA. A new method for correcting a gummy smile. *Plast Reconstr Surg* 1983;72:397-400.1.
8. Hossain MZ et al, Prevalence of malocclusion and treatment facilities at Dhaka Dental College and Hospital. *Journal of Oral Health*, vol: 1, No. 1, 1994
9. Ahmed N et al, Prevalence of malocclusion and its aetiological factors. *Journal of Oral Health*, Vol. 2 No. 2 April 1996
10. Khan RS, Horrocks EN. A study of adult orthodontic patients and their treatment. *Br J Orthod*, 18(3):183-194; 1991.
11. Salzmann JA. Practice of orthodontics. Philadelphia: J. B. Lippincott Company; p. 701-24; 1966.
12. McNamara, J.A.: Components of Class II malocclusion in children 8 10 years of age, *Angle Orthod*, 51:177-202; 1981.
13. Case C S. The question of extraction in orthodontia. *American Journal of Orthodontics*, 50: 660-691; 1964.
14. Case C S. The extraction debate of 1911 by Case, Dewey, and Cryer. Discussion of Case: the question of extraction in orthodontia. *American Journal of Orthodontics*, 50: 900-912; 1964.
15. Tweed C. Indications for the extraction of teeth in orthodontic procedure. *American Journal of Orthodontics* 30: 405-428; 1944.
16. Cleall JF, Begole EA. Diagnosis and treatment of Class II Division 2 malocclusion. *Angle Orthod* 52:38-60; 1982.

17. Strang RHW. Tratado de ortodoncia. Buenos Aires: Editorial Bibliográfica Argentina; 1957. p. 560-70, 657-71
18. Bishara SE, Cummins DM, Jakobsen JR, Zaher AR. Dentofacial and soft tissue changes in Class II, Division 1 cases treated with and without extractions. *Am J OrthodDentofacialOrthop* 107:28-37; 1995. Rock WP.
19. Treatment of Class II malocclusions with removable appliances. Part 4. Class II Division 2 treatment. *Br Dent J* 168:298-302; 1990.
20. Naragond A,<sup>1</sup> Kenganal S,<sup>2</sup> Sagarkar R,<sup>3</sup> and Sugaradday. Orthodontic Camouflage Treatment in an Adult Patient with a Class II, Division 1 Malocclusion – A Case Report, *J ClinDiagn Res.* 2013 Feb; 7(2): 395–400.
21. Kuhlberg, A. and Glynn, E.: Treatment planning considerations for adult patients, *Dent.Clin. N. Am.* 41:17-28; 1997.
22. Tweed C. Indications for the extraction of teeth in orthodontic procedure. *American Journal of Orthodontics* 30: 405–428; 1944.
23. Bishara S, Hession T, Peterson L. Longitudinal soft-tissue profile changes: a study of three analyses. *Am J Orthod.* 1985;88:209–23.
24. Alexander RG, Sinclair PM, Goates LJ. Differential diagnosis and treatment planning for adult nonsurgical orthodontic patient. *AmJrthod.* 1986;89:95–112.
25. Foster TD, Grundy MC. Occlusal changes from primary to permanent dentitions. *J Orthod* 1986; 13: 187–93.
26. Edwards JG. The diastema, the frenum, the frenectomy a clinical study. *Am J Orthod* 1977; 71: 489–508.
27. Kaimenyi JT. Occurance of midline diastema and frenum attachments among school children in Nairobi, Kenya. *Indian J Dent Res* 1998; 9:67-71.
28. Nainar SM, Gnanasundaram N. Incidence and etiology of midline diastema in a population in south India. *Angle Orthod* 1989; 59:277-82.
29. Pameijer JHN, Glickman I, Roeber FW. Intraoral occlusal telemetry III. Tooth contacts in chewing, swallowing and bruxism. *J Periodont.* 1969; 40:253-258.
30. Howell CT. Incisal relationships during speech. *J Prosthet Dent.* 1986;56: 93-98.