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

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Manuscript Info

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.

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.¹-⁴ 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.⁵ A gummy smile of skeletal origin occurs because of excessive vertical height of the maxilla; this requires orthognathic surgery.⁵ ⁶ A short upper lip is also a frequent cause of a gummy smile.⁷ The muscular type is caused by hyperactivity of the elevator muscles of the upper lip.⁸ Finally, a gummy smile might be...
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 gummymile. 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 OnClass 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 2nd molar in the lower right quadrant and also there was congenitally missing lower right 2nd premolar.

**Pre treatment intraoral photographs:**
Photographic analysis:

**EXTRA-ORAL EXAMINATION**

- Grossly symmetrical
- Leptoproscopic
- Mesocephalic
- Average width of the nose and mouth
- Competent lips
Smile arc: Non-Consonant
Upper midline: not coincident with the facial midline

FRONTAL VIEW: SMILING

Profile: Slightly Convex to Orthognathic
Lips: Competent
Nasolabial Angle: 103 deg
Pre treatment cephalometric readings:

### STEINER’S ANALYSIS

| 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°    | Retracted 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 tips  |

| 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           | 4mm    | Average                    |
| L1 to A - Pg                            | 1 ± 2mm          | 1mm    | 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 ±2mm          | 1mm    | Average                    |

### McNamara Analysis

| Measurement                             | Mean | Pre Rx | Inference                  |
|-----------------------------------------|------|--------|----------------------------|
| N perp - A                              | 0 -1mm | 1mm    | Average                    |
| N perp to Pog                           | 0-4mm | 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                    |
| Maxillo-mandibular differential         | 19mm  |        | Reduced                    |
| Lower ant. Facial ht (ANS-Me)           | 55mm  |        | Reduced                    |
| U1 to Pt. A                             | 4-6mm | 6 mm   | Average                    |
| L1 to A-Pog                             | 1-3mm | 1mm    | Average                    |
| Nasolabial angle                        | 102° ± 8°      | 102°   | Average Nasolabial angle   |
| Pharyngeal analysis                     | U     | 15-20  | Adequate upper and lower airway passage |
|                                        | L     | 11-14  |                             |
## 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 max incisors      |

## HOLDAWAYS SOFT TISSUE ANALYSIS

| Measurement                      | Mean     | Pre Rx | Inference                      |
|----------------------------------|----------|--------|--------------------------------|
| Facial angle                     | 90± 3°   | 85°    | Average                        |
| Upper lip curvature              | 2-5 mm   | 5 mm   | 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 +2 mm | 2 mm | Average                        |
| Lower sulcus depth               | 5 mm     | 5 mm   | Average                        |
| Soft tissue chin thickness       | 10-12 mm | 14 mm  | Increased soft tissue chin thickness |
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 17 years 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                      |
|----------------------|---------------------------------------------------------------------------------|--------------------|---------------------------------|
| **Dental**           | ➢ Multiple rotated teeth  
➢ Crowding in upper and lower anterior teeth  
➢ Retroclined max incisors  
➢ Retained Deciduous 75 and 85  
➢ Congenitally missing 45 | Increased overbite | Scissor bite with 15 and 44, 25 and 35 |
| **Skeletal**         | ➢ Class II skeletal pattern                                                      | Horizontal growth  | pattern                         |
| **Soft tissues**     | ➢ 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
Model Analysis:

Treatment progress:
The deciduous 2nd 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 1st 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 1st 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 2nd 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 Hawleys 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 debondingecephalometric 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 Class 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 therapeutic 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 Orthod1977;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 orthognathic surgery 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.
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 aetiologi 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 Orthod Dentofacial Orthop 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, Kenganal S, Sagarkar R, and Sugaradday. OrthodonticCamouflage Treatment in an Adult Patient with a Class II, Division 1 Malocclusion – A Case Report, J Clin Diagn 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. Differetial diagnosis and treatment planning for adult nonsurgical orthodontic patient. Am J Orthod. 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. Occurrence of midline diastema and frenum attachments among school children in Nairobi, Kenya. Indian J Dent Res 1998; 9:67-71.

28. Nair 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.