



## Evaluation of Soft Tissue Changes on Lateral Cephalometric X-Ray Associated with Lip Repositioning Surgery and/or Botulinum Toxin Injections in Gummy Smile Cases. Randomized Clinical Study

Noury Adel Saed Abd El Kafe<sup>1</sup>, Bahaa Eldin A Tawfik<sup>2</sup> and Abdalla S Nouh<sup>3\*</sup>

<sup>1</sup>Oral and Maxillofacial Surgery Specialist, Cairo, Egypt

<sup>2</sup>Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine (Boys), Al-Azhar University, Cairo, Egypt

<sup>3</sup>Nuclear and Radiological Regulatory Authority, (NRRRA), Nasr City, Cairo, Egypt

\*Corresponding Author: Abdallah S Nouh, Nuclear and Radiological Regulatory Authority, (NRRRA), Nasr City, Cairo, Egypt.

Received: July 03, 2021

Published: July 27, 2021

© All rights are reserved by Noury Adel Saed Abd El Kafe., et al.

### Abstract

**Aim:** The objective of the current study was to evaluate the soft tissue changes on the lateral cephalometric x-ray associated with the lip repositioning surgery and/or botulinum toxin injections.

**Methods:** Thirty female patients were included in this study who suffered from gummy smile owing to hypermobility of the upper lip. Lateral cephalometric x-ray was obtained for all patients where soft tissue analysis was done by tracing using software program and the interlabial distance and lip length at rest were verified. Patients were divided at random into 3 groups, group 1 were treated with lip repositioning surgery, group 2 were treated with botulinum toxin injections and group 3 was treated by botox injections followed by lip repositioning surgery after 14 days. Postoperative assessment included recording the changes in the same preoperative measurement.

**Results:** Post-operative assessment using lateral cephalometric soft tissue showed an increase in the upper lip length with a decrease in the inter-labial distance at rest in the third group.

**Conclusion:** Lateral cephalometric soft tissue analysis has been proven to provide adequate information about the upper lip changes associated with both procedures.

**Keywords:** Botox; Lip Repositioning; Gummy Smile; Upper Lip

### Introduction

Nowadays, a great concern for beauty and physical appearance has motivated the dentist to assess the essentials of patient's smile and to give a great attention to the whole frame of the smile in terms of the dentition, gingiva and lips. Managements of cases with dentofacial deformities are considered a hard task and a very challenging decision. With the advent of modern cosmetic dentistry, several materials and methods have been advocated to achieve the desired esthetic outcome.

A pleasant smile depends on the amount of gingival where the accepted amount of gingival is 1-3 mm of pink attached gingiva, measured from the free gingival margin of the upper central incisor to the inferior border of the upper lip. An exposed gingiva more than 3 mm is considered to be unattractive and commonly known as gummy smile [1].

Apparently, excessive gingival display is of multiple origins and several literatures explained the different etiologies [2]. Extreme anterior maxillary height, hypermobility of the elevator muscles

of the upper lip, delayed passive eruption, dentoalveolar extrusion and short upper lip. A variety of techniques were proposed in each cause with different therapeutic outcomes such as; gingivectomy [3], crown lengthening [4], orthognathic surgery [5], lip repositioning surgery [6,7] and botox injections [8,9].

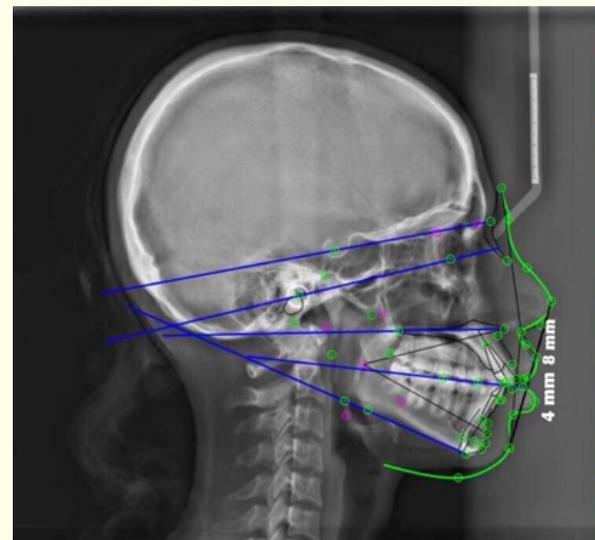
Understanding craniofacial morphologic character in patients with gummy smile could assist the treatment plan and evaluation of the changes that occur in parameters that are associated with the treatment procedure itself, allowing us to be in the right track of proper addressing the problem. The method of cephalometric radiography caused the progress of several cephalometric works concerning norms that supply valuable guiding in diagnostic and treatment plans especially in maxillofacial surgery and orthodontics. Clinical facial analysis in addition to soft tissue cephalometric helps to improve the facial balance and aids in proper treatment planning that's why performing this study to reveal much of the soft tissue changes accompanying the proposed aesthetic procedure.

### Patients and Methods

The sample size of the current study is thirty female patients selected from a private clinic with an age range of 23 - 30 years old complaining of excessive gingival display during smiling. They were refereed to have balanced facial profile from a board of orthodontists. They all had a class I occlusion, no history of orthodontic treatment, maxillary anterior teeth had normal proportions from a periodontal point of view, no history of any systemic diseases. All patients were first assessed clinically by diagnosing the causative factor; only patients who had gummy smile due to hypermobility of the elevator muscles of the lip were enrolled in the study. Diagnosis of upper lip hypermobility was done by measuring the lip length at rest and on smiling where the measurement is recorded as the vertical distance from the subnasale to the stomion point [10], the upper lip hypermobility occurs when the upper lip translates from repose to smiling at a distance greater than or double the normal amount of translation which is 6 - 8 mm [11]. All patients were diagnosed of having an excessive gingival display ranging from 4 - 6 mm with ruling out upper lip hypermobility as the causative factor. Patients who had gummy smile due to vertical maxillary excess, distorted passive eruption, dentoalveolar extrusion and plaque induced gingivitis were excluded from the study. Lip repositioning process and/or botulinum toxin injections was discussed with the patients as a treatment option and a written knowledgeable approval was obtained prior to the process.

Our study has been carried out in full harmony with the World Medical Association Declaration of Helsinki in 2000 and the re-

search has been separately refereed and accepted by an Ethical group review board at Al Azhar University. A lateral head film was attained with the participant in natural head position with seated condyle and passive lips. All lateral cephalometric films were obtained by the same operator. Then, they were traced using both a software program and on a transparent cellulose acetate sheet. All reference points were first recognized, located and marked. Our points of concern for measurement were the upper lip length and the interlabial distance at rest. The upper lip length was recorded as the distance from subnasale "Sn" to stomion superiorus "Stms" [11], where the interlabial distance at rest was recorded as the distance from the inferior border of the upper lip to the superior border of the lower lip [12] (Figure 1).



**Figure 1:** Lateral cephalometric soft tissue tracing and measuring the interlabial distance and lip length at rest.

Patients were divided at random into three equal groups: group 1 was treated with lip repositioning surgery, group 2 was treated with botox injections and group 3 were treated with botox injections followed by lip repositioning surgery after 14 days.

### Group 1

#### Surgical lip repositioning procedure

Study participants were anaesthetized by bilateral infraorbital anesthesia in addition to infiltration technique. The incision outline was noticeable by an ineffaceable pen previous to the incision placement. A partial thickness inferior incision was formed with

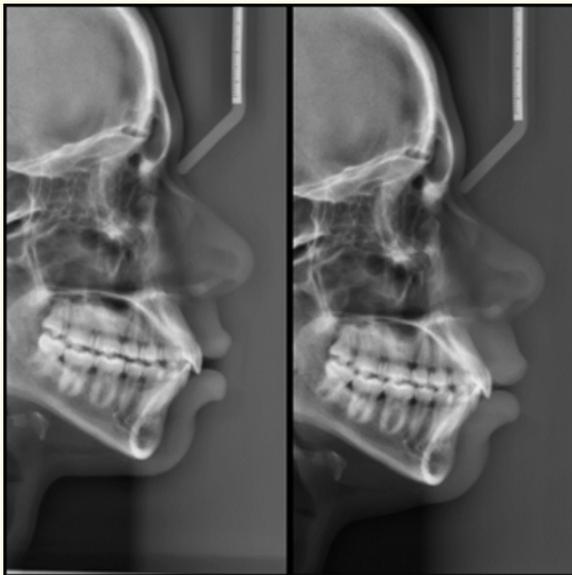
a no. 15 blade on the mucogingival junction followed by another superior incision above and parallel to it at a distance double the amount of gingival display. The two incision lines were extended horizontally to the mesial line angle of the upper first molar on each side and were connected to each other mesially and distally to create an overall elliptical outline, the strip of the outline mucosa was removed leaving behind a bed of connective tissue this was followed by placement of key sutures at the canine and premolars area bilaterally. Complete closure was then obtained by multiple interrupted sutures among each of the previous key sutures using polyglycolic resorbable 5-0 suture.

### Group 2 botox injection

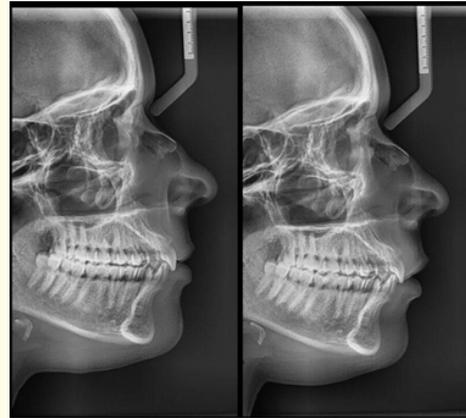
Botulinum toxin was diluted according to manufacture instructions, target points for injection was identified as yonsei point bilaterally which is a point 1 cm from the ala of the nose [8].

### Group 3

Botox injections were applied as in group 2 followed by lip repositioning surgery in the same manner as in group 1 after 14 days (Figure 2-4).



**Figure 2:** (A) preoperative, (B) 14 days after lip repositioning surgery,



**Figure 3:** (A) preoperative, (B) 14 days after botox injection.



**Figure 4:** (A) preoperative, (B) 14 days after botox injection and lip repositioning.

### Postoperative care

Patients who underwent the surgery were prescribed an analgesic, antibiotic once each 12 hours for 1 week in addition to anti-inflammatory twice daily for 1 week. Postoperative commands

incorporated, using ice packs on the upper lip area for the first 24 hours and minimizing lip movements when smiling or talking for the first 2 weeks postoperatively. On the other hand, patients with botulinum toxin injections were instructed not to engage in any exercises or exposure to sun-light and to avoid washing their face or applying pressure to the injections points for the first 4 hours. Patients were recalled after 2 weeks to evaluate the healing pattern, postsurgical pain and swelling. Sutures were removed after two weeks and the surgical site was reviewed for any possible signs of infection. Patients were followed up at 14 days, 4 months, 8 months and 12 months.

### Statistical analysis

The mean and standard deviation values were computed for every group in each test. Data were investigated for normality applying Kolmogorov-Smirnov and Shapiro-Wilk tests, data demonstrated parametric (normal) distribution.

One-way ANOVA pursued by Tukey post hoc test was applied to compare between more than two groups in non-related samples.

The significance level was set at  $P \leq 0.05$ . Statistical analysis was done with IBM® SPSS® Statistics Version 20 for Windows.

## Results

### Inter-labial distance (percentage of change)

#### BI-14 days

There was a statistically significant difference between group 1, group 2 and group 3 where ( $p < 0.001$ ).

A statistically significant difference was found between group 2 and each of group 1 and group 3 where ( $p = 0.002$ ) and ( $p < 0.001$ ).

No statistically significant difference was found between group 1 and group 3 where ( $p = 0.156$ ).

#### BI-3m

There was a statistically significant difference between group 1, group 2 and group 3 where ( $p < 0.001$ ).

A statistically significant difference was found between group 1 and each of group 2 and group 3 where ( $p = 0.001$ ) and ( $p = 0.004$ ).

Also, a statistically significant difference was found between group 2 and group 3 where ( $p < 0.001$ ).

#### BI-6m

There was a statistically significant difference between group 1, group 2 and group 3 where ( $p < 0.001$ ).

A statistically significant difference was found between group 3 and each of group 1 and group 2 where ( $p < 0.001$ ).

No statistically significant difference was found between group 1 and group 2 where ( $p = 1$ ).

#### BI-1 year

There was a statistically significant difference between group 1, group 2 and group 3 where ( $p < 0.001$ ).

A statistically significant difference was found between group 3 and each of group 1 and group 2 where ( $p < 0.001$ ).

No statistically significant difference was found between group 1 and group 2 where ( $p = 1$ ). The mean, standard deviation (SD) values of Inter-labial distance of the different groups are given in table 1 and the bar chart representing Inter-labial distance for different groups is shown in figure 5.

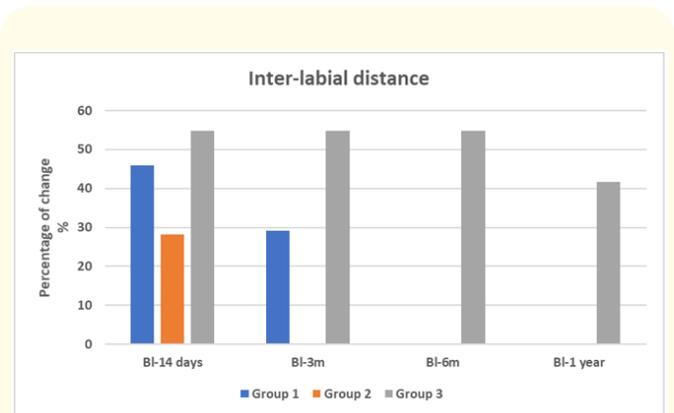


Figure 5: Bar chart representing Inter-labial distance for different groups.

| Variables | Inter-labial distance (Percentage of change) |       |          |       |          |       |           |       |
|-----------|--|-------|----------|-------|----------|-------|-----------|-------|
|           | Bl-14 days                                   |       | Bl-3m    |       | Bl-6m    |       | Bl-1 year |       |
|           | Mean   | SD    | Mean     | SD    | Mean     | SD    | Mean      | SD    |
| Group 1   | 46.00  | 9.40  | 29.17    | 23.95 | 0.00     | 0.00  | 0.00      | 0.00  |
| Group 2   | 28.17  | 5.74  | 0.00     | 0.00  | 0.00     | 0.00  | 0.00      | 0.00  |
| Group 3   | 54.83  | 14.15 | 54.83    | 14.15 | 54.83    | 14.15 | 41.67     | 12.98 |
| p-value   | < 0.001*                                     |       | < 0.001* |       | < 0.001* |       | < 0.001*  |       |

**Table 1:** The mean, standard deviation (SD) values of Inter-labial distance of different groups

\*: Significant (p < 0.05).

**Gingival display (percentage of change)**

**Bl-14 days**

There was a statistically significant difference between group 1, group 2 and group 3 where (p < 0.001).

A statistically significant difference was found between group 1 and each of group 2 and group 3 where (p < 0.001).

Also, a statistically significant difference was found between group 2 and group 3 where (p < 0.001).

**Bl-3m**

There was a statistically significant difference between group 1, group 2 and group 3 where (p < 0.001).

A statistically significant difference was found between group 3 and each of group 1 and group 2 where (p < 0.001).

No statistically significant difference was found between group 1 and group 2 where (p = 0.054).

**Bl-6m**

There was a statistically significant difference between group 1, group 2 and group 3 where (p < 0.001).

A statistically significant difference was found between group 3 and each of group 1 and group 2 where (p < 0.001).

No statistically significant difference was found between group 1 and group 2 where (p = 1).

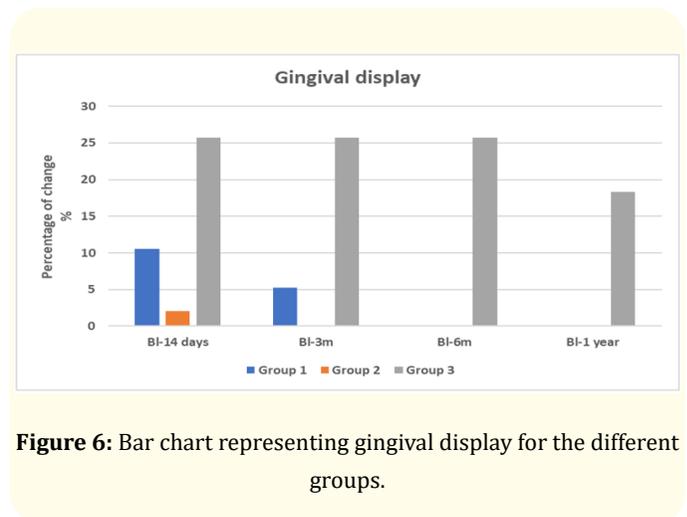
**Bl-1 year**

There was a statistically significant difference between group 1, group 2 and group 3 where (p < 0.001).

A statistically significant difference was found between group 3 and each of group 1 and group 2 where (p < 0.001).

No statistically significant difference was found between group 1 and group 2 where (p = 1).

The bar chart representing the gingival display for the different groups is shown in figure 6. Also, the mean, standard deviation (SD) values of Gingival display of the different groups are given in table 2.



**Figure 6:** Bar chart representing gingival display for the different groups.

| Variables | Gingival display (Percentage of change) |      |          |      |          |      |           |      |
|-----------|---|------|----------|------|----------|------|-----------|------|
|           | Bl-14 days                              |      | Bl-3m    |      | Bl-6m    |      | Bl-1 year |      |
|           | Mean                                    | SD   | Mean     | SD   | Mean     | SD   | Mean      | SD   |
| Group 1   | 10.53                                   | 2.85 | 5.22     | 6.80 | 0.00     | 0.00 | 0.00      | 0.00 |
| Group 2   | 2.02                                    | 4.40 | 0.00     | 0.00 | 0.00     | 0.00 | 0.00      | 0.00 |
| Group 3   | 25.71                                   | 4.72 | 25.71    | 4.72 | 25.71    | 4.72 | 18.33     | 5.25 |
| p-value   | < 0.001*                                |      | < 0.001* |      | < 0.001* |      | < 0.001*  |      |

**Table 2:** The mean, standard deviation (SD) values of Gingival display of different groups.

\*: Significant (p < 0.05).

## Discussion

Amazing smile is an important character of attractiveness to which culture gives a growing significance presently. The main components for perfect smile are: gum, teeth, and lips. Recreantly, the knowledge concerning attractiveness and physical appearance became the role of each clinician to assess the essential features of patient's smile and connection the active relations among the teeth, gingiva, and lips mutually on smiling. The gingiva is one of the most important aspects that are taken into consideration in the evaluation of the smile, in which the upper lip should be elevated around 80% of its normal length, exposing teeth and gingival [13]. The aim of the present study was to assess the soft tissue changes on the lateral cephalometric x-ray associated with the lip repositioning surgery and/or botulinum toxin injections.

Although many topics discussed treatment of gummy smile either by orthodontic treatment, crown lengthening, botox or lip repositioning, few were discussed botox followed by lip repositioning. Comparing the present study with the previous literatures, the results of the current study demonstrated an increase in the upper lip length and decrease in interlabial distance, which agrees well with Lobna Abdel Aly and Nelly Ibrahim Hammouda [14] where they investigated that after 4 weeks, a decrease from 8 mm gingival exposure to 3 mm. This was considered as normal gingival display for an adult during smiling. On the other hand, the results of our study showed disagreement with Mohamed O. Makkiah [15] who pointed out that the BTX-A injection displays enhanced outcome than those of surgery and had given more safer and acceptable results than lip repositioning. Additionally, it disagrees with Zainab Abdel-Rahman Mohammed., et al. [16] who found no significant result in upper lip length and interlabial distance. However the technique used as each case has its treatment plan which depends on proper diagnosis, the main concern is the maximum patient satisfaction with no invasive procedures.

## Conclusion

Lateral cephalometric soft tissue analysis has been proven to provide adequate information about the upper lip changes associated with both procedures.

Botox alone is effective but temporary treatment. Surgery alone exhibits recurrence in most of the cases. Both procedures, botox followed by lip repositioning show the maximum stability results.

## Consent

Fully recorded by every patient.

## Bibliography

1. Allen EP. "Use of mucogingival surgical procedures to enhance esthetics". *Dental Clinics of North America* 32 (1988): 307-330.
2. Sahoo KC., et al. "Botox in gummy smile – A review". *Indian Journal of Dental Sciences* 1 (2012): 51-54.
3. Garber DA and Salama MA. "The aesthetic smile: diagnosis and treatment". *Periodontology* 2000 (1996): 18-28.
4. Silberberg N., et al. "Excessive gingival display – etiology, diagnosis, and treatment modalities". *QJ. Quintessence International* 40 (2009): 809-818.
5. Ezquerra F, et al. "New approach to the gummy smile". *Plastic and Reconstructive Surgery* 104 (1999): 1143-1150.
6. Rosenblatt A and Simon Z. "Lip repositioning for reduction of excessive gingival display: a clinical report". *The International Journal of Periodontics and Restorative Dentistry* 26 (2006): 433-437.
7. Faus-Matoses V, et al. "Lip repositioning technique. A simple surgical procedure to improve the smile harmony". *Journal of Clinical and Experimental Dentistry* 10.4 (2018): e408-e412.
8. Hwang WS., et al. "Surface anatomy of the lip elevator muscles for the treatment of gummy smile using botulinum toxin". *The Angle Orthodontist* 79 (2009): 70-77.
9. Polo M. "Botulinum toxin type A (Botox) for the neuromuscular correction of excessive gingival display on smiling (gummy smile)". *American Journal of Orthodontics and Dentofacial Orthopedics* 133 (2008): 195-203.
10. Peck S., et al. "The gingival smile line". *The Angle Orthodontist* 62 (1992): 91-100.
11. Bhola M., et al. "The Lip Stabilization Technique- Indications and Guidelines for Case Selection and Classification of Excessive Gingival Display". *The International Journal of Periodontics and Restorative Dentistry* 35.4 (2015): 549-559.
12. Wu H., et al. "Classification and craniofacial features of gummy smile in adolescents". *The Journal of Craniofacial Surgery* 21 (2010): 1474-1479.

13. Basel Mahardawi., *et al.* "Gummy Smile: A Review of Etiology, Manifestations, and Treatment Corresponding". *The Siriraj Medical Journal* 71 (2019): 168-174.
14. Lobna Abdel Aly and Nelly Ibrahim Hammouda. "Botox as an adjunct to lip repositioning for the management of excessive gingival display in the presence of hypermobility of upper lip and vertical maxillary excess". *Journal of Dental Research* 13.6 (2016): 478-483.
15. Mohammad Osama Makkiah. "Assessment of the Efficiency of Botox and Lip Reposition in the Correction of the Gummy. According To the Patients' Satisfaction". *Oral Health and Dental Science* 1.1 (2017): 1-4.
16. Zainab Abdel-Rhman Mohammed., *et al.* "Botox A Injection Compared with Modified Lip Repositioning Surgery in the Treatment of Adult Patients with Gummy Smile Due to Hypermobile Upper Lip". *Acta Scientific Dental Sciences* 5.3 (2021): 142-153.

**Volume 5 Issue 8 August 2021**

**© All rights are reserved by Noury Adel Saed Abd El Kafe., *et al.***