



Prevalence of Gummy Smiles in Leptoprosopic Patients and Various Treatment Modalities Employed in South Indian Population

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Article History:

Received on: 03 Sep 2020

Revised on: 05 Oct 2020

Accepted on: 07 Oct 2020

Keywords:

Gummy smile,
Intrusion,
Leptoprosopic,
Le-fort 1 superior
impaction

ABSTRACT

Patients with a vertical growth pattern have a tendency for a long face and gummy smile due to the clockwise rotation of the mandible and ensuing divergence of maxillary bases. A patient can be said to have a gummy smile when there is gingival exposure of 3mm or more while smiling. A gummy smile is unaesthetic and warrants correction. The common treatment modalities employed for correction are dental intrusion and surgery. The study aimed to determine the number of patients with leptoprosopic facial patterns having gummy smiles and the various treatments for its correction. The objective of this study was to determine whether all leptoprosopic patients have a tendency towards gummy smiles and the treatment plan most commonly used for its correction. Records from the Department of Orthodontics were retrieved and searched for the patients with leptoprosopic facial type. Only 42 patient records were eligible according to the selection criteria of which (n=22) were females and (n= 20) were males. Selection criteria included patients who had a long face with facial index between 90-94%, on cephalometric evaluation female patients with upper dental facial height $>27.4 \pm 1.7$ mm and male patients $>30.5 \pm 2.1$. The results showed that the patients with leptoprosopic facial patterns had a tendency towards gummy smiles and the treatment plan most commonly used for its correction in the Department of Orthodontics in Saveetha dental college was skeletal intrusion using dental mini implants and IZC. Other treatment modalities included Le-Fort Superior Impaction of maxilla in severe cases. Association between gender the various treatments employed for gummy smile correction was statistically insignificant ($p > 0.05$). We can conclude that gummy smile and facial patterns have a positive correlation.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL3.3414>

Production and Hosted by

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INTRODUCTION

A patient's smile can express joy, success, courtesy, show confidence and kindness. Smile is more than a form of communication; it is a kind of socialization and attraction (Moura *et al.*, 2017). Sufficient tooth structure is required above the attached gingiva. Gummy smile is recognized by the American Academy of Periodontology (AAP) as a mucogingival deformity and mucogingival condition that affects the area around the teeth. Etiology is multifactorial and related to an excessive vertical growth of the maxilla (Reddy *et al.*, 2006), reduced

length of the upper lip, excessive contraction of the upper lip (Hwang *et al.*, 2009), and disproportionate crown length and width of anterior teeth associated with excessive gingival display, hyperplasia/passive eruption (Gibson and Tatakis, 2017), upper teeth extrusion associated with deep bite (Gibson and Tatakis, 2017).

The etiology of gummy smile is associated with its classification and will establish a correct diagnosis upon which all kinds of treatment will be based (Ravichandran, 2017). Thus, we need to establish the diagnosis to determine correct treatment for gummy smile (Lin *et al.*, 2015).

Patients with long faces are usually associated with increased lower anterior facial height, reduced bizygomatic width, narrow apical base and a steep mandibular plane angle (Govindaraj *et al.*, 2018) and excessive vertical growth present in patients with a gummy smile (Wu *et al.*, 2010). Increase of the upper 1/3rd of the face is characterized by vertical maxillary excess (VME) with lip incompetence and excessive gingival show. Gummy smiles are thus strongly linked with anterior vertical maxillary excess of 2-3mm (Peck and Peck, 1995).

There are various well established treatments for VME depending on the severity of the problem like Surgery, Temporary anchorage devices and Intrusion arches. The introduction of Temporary anchorage devices (TAD's) have put the orthodontist in a difficult situation of when to use TADs for Intrusion rather employ the invasive procedure of a surgical Lefort Impaction. The envelope of discrepancy states that in the maxillary arch the amount of intrusion that can be achieved using skeletal anchorage is 6mm, but only around 4mm of intrusion was found to be stable (Govindaraj *et al.*, 2018; Dinesh *et al.*, 2013)

Mini implant biomechanics involved is completely different from conventional orthodontic mechanics for group distalization, arch intrusion, etc. (Felicita, 2018a). Treatment most commonly used can be intrusion with mini implants or surgery. Intrusion of maxillary incisors is one of the difficult tooth movements to achieve orthodontics (Kumar *et al.*, 2011). A variety of techniques were used in the past to intrude the maxillary incisors before the emergence of mini implants in Orthodontics (Felicita, 2017a). Mini implants are temporary anchorage devices used to produce various tooth movements. One research was carried. Jain *et al.* carried out research to evaluate and compare the effectiveness of intrusion of maxillary incisors using mini implants, utility arch and j- hook headgear. Conclusion was that both mini implants and util-

ity arch could be used to attain good amounts of incisor intrusion, mini implants produce true intrusion without any other ill-effects (Jain *et al.*, 2014). Mini implants were introduced to control tooth movements in a precise manner during orthodontic treatment for correcting bite problems which otherwise would require surgery like superior impaction (Sripradha and Pandian, 2018).

The general rule is that if impaction required is more than 5mm, the ideal choice of treatment would be a Lefort 1 osteotomy. The Lefort 1 impaction usually causes autorotation which further enhances the overall impaction. The envelope of discrepancy states that the amount of intrusion that can be achieved using surgery is 10mm, but the amount of intrusion that can be achieved by a Lefort 1 osteotomy is around 8mm in the incisor region and around 5 mm in the molar region (Govindaraj *et al.*, 2018).

Previously many clinical trials (Felicita, 2017b; Felicita *et al.*, 2012; Felicita, 2018b; Samantha *et al.*, 2017), case reports (Kamisetty *et al.*, 2015; Viswanath *et al.*, 2015) have been conducted by our team. Now, we are making efforts to make use of the vast database available in our university and do more research.

Hence the aim of this study was to establish whether long face patients have a tendency towards showing gummy smiles and to determine the most common method used for its correction in the institution.

MATERIALS AND METHODS

Patients records from the Department of Orthodontics in Saveetha dental college were taken as subjects for the study. A sample size of 42 patients which met the selection criteria was included in this study which had male patients (n = 20) and female patients (n = 24). Selection criteria for the patients were

1. Facial index percentage above the range of 90-94%.
2. Upper anterior dental height greater than 27.4+/-1.7mm for females and greater than 30.5+/-2.1mm for males. These were considered as patients with leptoprosopic faces and anterior maxillary excess, respectively.
3. Frontal smile photographs of patients were collected which were standardized. Patients with gingival exposure greater than 3mm were considered as patients with gummy smiles (Figure 1).

Total Number of patients with gummy smiles among the leptoprosopic patients were counted and results were obtained. The treatment employed for those with gummy smiles by Orthodontic Postgraduates in Saveetha university was recorded.

RESULTS AND DISCUSSION

Statistics done for the studies were frequency distribution to determine the number of patients with gummy smiles among long face patients and treatment employed for gummy smiles. Chi-square test was done to find out gender distribution in treatments employed for gummy smiles.



Figure 1: Patient with gingival exposure (gummy smile)

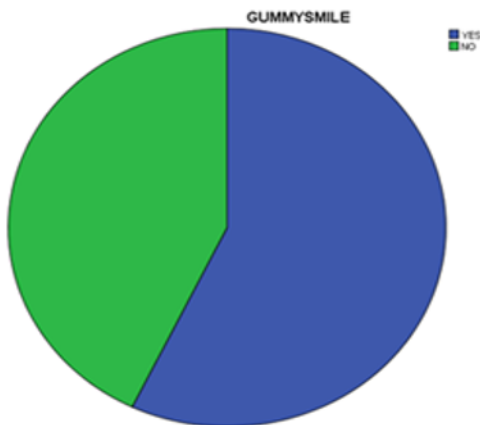


Figure 2: Pie chart showing presence of gummy smile in long face patients

1. Out of the 42 leptoprosopic patients, 24 of them had gummy smiles, i.e. 57% of the patients had gummy smiles (Figure 2).
2. Of the 22 females, 14 had gummy smile (Figure 3). Of the 20 males, 10 of them showed the presence of gummy smiles (Figure 3).

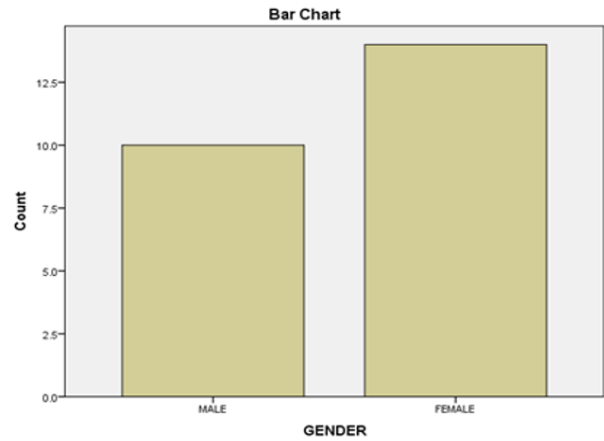


Figure 3: Bar graph depicting prevalence of gummy smile based on gender

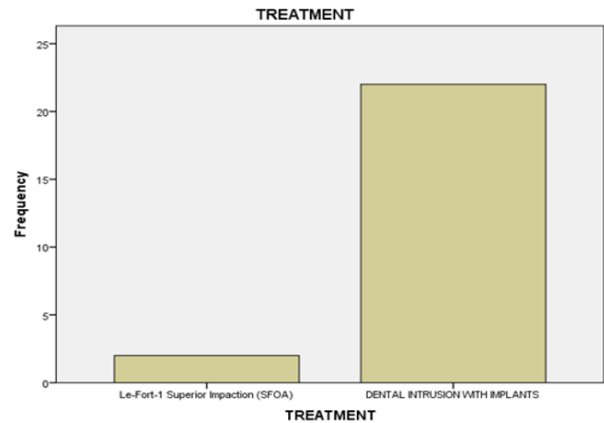


Figure 4: Bar graph depicting various treatments used for gummy smile correction in patients with leptoprosopic facial shape

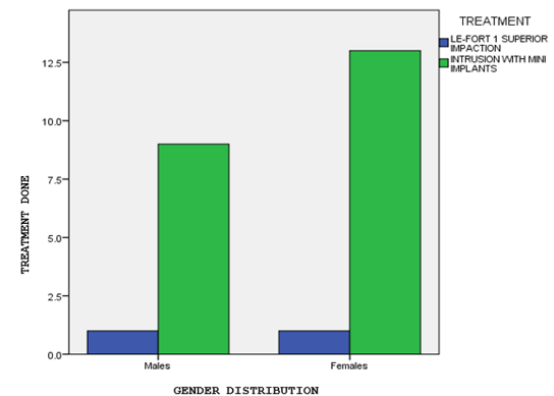


Figure 5: Bar graph depicting association between gender and the treatments used incorrection of gummy smiles

3. 8.3% of the gummy smiles patients were treated with Le-Fort 1 Superior impaction of the maxilla. 91.7% were treated with intrusion with mini implants. (Figure 4).
4. Gender distribution was calculated in the various treatments employed for gummy smile. The results showed that out of 10 males and 14 females, 1 male and 1 female underwent Le-Fort 1 superior. Whereas, 9 males and 13 females underwent gummy smile correction using mini implants. Chi-Square test showed that the results were statistically insignificant. ($p > 0.05$) (Figure 5).

The term “gummy smile” is known to the dental community and especially to orthodontists (Affrin and Ganapathy, 2020). Most times, some exposure of gums during a smile is more than acceptable. However, when excessive amounts of gingival tissue is exposed during smiling or when lips are at rest, an esthetic problem is apparent (Redlich et al., 1999). Ideal vertical positioning for the maxillary incisors is of superior importance in attaining good esthetics. Over extrusion of maxillary incisors may be seen when there is severe overbite or gummy smile (Sivakumar et al., 2018).

Patients with a high smile line tend to have gummy smiles (Ashok and Ganapathy, 2017). Reason for gummy smile can be “static” caused due to defects in bones, soft tissues and their relationships (Krishnan and Pandian, 2015). The other is “dynamic”, that is, the way one smiles, the quantity and tension of the related muscles and smiling habits (Wu et al., 2010).

The following could be a few reasons for gummy smile, including excessive maxillary vertical growth, short upper lip, incomplete anatomical crown exposure or combination of many factors. Mouth breathing can exacerbate this condition.

In a study by Wu.H et al., they found that subjects with class II skeletal malocclusions and vertical growth patterns and not class III with horizontal growth patterns had high prevalence of gummy smiles. Hence, it was postulated that gummy smile not only originated from maxilla but also from location of the mandible (Wu et al., 2010; Rubika et al., 2015).

In this study, the objective was to determine if there existed any relation between facial patterns and gummy smiles. We found that 57% of the total long face subjects that had reported to the department of Orthodontics had gummy smiles, which was not esthetically pleasing and warranted correction. Gummy smile was confirmed by considering cases

who had greater than 3mm gingival anterior exposure and upper anterior dental height greater than average value indicating vertical maxillary excess. Thus, this study concluded leptoprosopic patients or vertically growing patients had a tendency to gummy smiles.

Various treatment approaches can be employed for treatment of gummy smile. It can be an interdisciplinary approach between Orthodontists, periodontists, and oral surgeons. It can even be dealt with by individual specialists. Marcelo Tomas et al. presented the following treatment options for gummy smile correction (Pereira et al., 2013).

1. Orthognathic surgery in cases of excessive vertical growth;
2. Orthodontic mechanics associated with intrusive mini implants in cases of overbite with extrusion of upper anterior teeth, and additional periodontal surgery to remove excessive gingival tissue and bone volume, resulting from the applied mechanics;
3. Periodontal surgery for cases of excessive gingival display or passive eruption;
4. Surgery of the muscle tissue for cases of short upper lip;

One of the studies concluded that the most frequently used treatment was gingivectomy with osteotomy (Moura et al., 2017). In this study dental intrusion with crown lengthening (Vellayappan, 2017) was done. Crown lengthening and lip repositioning (Ramesh et al., 2019) was used by Monica et al. In a study by Izraelewicz et al. in 2015, the following treatment plans were summarized for gummy correction (Izraelewicz-Djebali and Chabre, 2015):

1. Orthodontic correction or orthognathic surgery
2. Gingivoplasty and implants
3. Orthodontic correction and intrusion with implants
4. Botulinum toxin injection

Mini-implants have become an essential armamentarium component in resistance to unwanted tooth movement during orthodontic treatment which provides absolute skeletal anchorage so can be used for intrusion avoiding surgery (Sivamurthy and Sundari, 2016).

In this study, in the department of orthodontics, postgraduates used the following two methods most commonly (Vikram et al., 2017).

1. Intrusion with dental mini implants/ IZC's.
2. Le-Fort 1 superior impaction of the maxilla (Christabel et al., 2016).

Intrusion using skeletal anchorage was most commonly used in the department owing to it being less invasive as compared to surgery. One of the main reasons being patient compliance and co-operation. Le-Fort 1 Superior impaction was mainly employed for excessive gingival exposure beyond 10mm.

Considering the limitations of the study, the sample size was very small and restricted to one department and one university, hence limitations to the options of treatment employed. Age range was not classified and not specified. This study needs to be conducted on a larger scale with larger sample size and specific age range for accurate results. Multi-disciplinary approach needs to be used for effective treatment.

In Figure 2, blue colour of the chart represents that 57.1% of leptoprosopic patients showed presence of gummy smiles and green colour representing that 42.9 % of leptoprosopic patients did not show gummy smiles. In Figure 3, X-axis represents the gender. Y-axis represents the total number of males(41.67%) and females(58.3%) that had gummy smiles. The number of female patients was only marginally higher as compared to male patients. In Figure 4, X axis represents the type of treatment employed for correction. Y-axis represents the total number of patients treated for gummy smiles. Large number of patients have undergone intrusion for correction of gummy smile using mini implants (91.7%) as compared to LeFort 1 Superior impaction (8.3%). In Figure 5, blue colour denotes the Le - Fort 1 Superior impaction and green colour denotes intrusion with mini implants. X-axis represents gender distribution of the treatment done for the correction of gummy smiles in males and females. Y-axis represents the total number of males and females undergoing different treatments. Large numbers of males as well as females have undergone intrusion for correction of gummy smiles using mini implants as compared to surgical intervention. However, this is statistically not significant. Pearson's Chi-Square value - 0.062, p-value - 0.803 (>0.05), hence results not significant.

CONCLUSION

Thus, the conclusion of this study was that leptoprosopic patients have a strong tendency towards a gummy smile. Treatment most commonly planned was intrusion with mini- implants and in severe

cases superior impaction of the maxilla was considered. Association between gender the various treatments employed for gummy smile correction was statistically insignificant.

Conflict of Interest

The authors declare that there is no conflict of interest for this study.

Funding Support

The authors declare that they have no funding support for this study.

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