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Management of excessive gingival display with mucosal coronally positioned flap

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SUMMARY

Objective. Current methods of managing excessive gingival display, an aesthetic concern, with gingivectomy, orthodontic intrusion, restorative dentistry and even botulinum toxin, have often been unsatisfactory. This study evaluates the efficacy of mucosal coronally positioned flap (MCPF) for reduction of gingival display.

Material and methods. Eight healthy patients, above 18 years, with either short or hyperactive upper lip, gingival display ≥4 mm during smiling or vertical maxillary excess, were recruited into the study. The smile line, upper lip length, upper lip vermillion length, distance between the lips and amount of gingival display along with clinical indices were assessed. The patients then underwent MCPF procedure and were re-evaluated for healing of the surgical site after 15 days and at 3 months. Patients also provided their perceptions of outcome of treatment, through a questionnaire. Paired t test and Repeated measures ANOVA were used for data analysis.

Results. Significant improvement in the gingival display was noted 3 months after the procedure, while no concomitant changes were observed in other parameters like upper lip length, vermillion length and distance between the lips post operatively.

Conclusion. The results of the study suggest that the MCPF procedure provides satisfactory results in terms of reduction of gingival display. Simplicity of the surgical procedure makes it an attractive option for patients without any gross skeletal abnormalities.

Keywords: gingiva, lip, smiling, surgical flap, vestibuloplasty.

INTRODUCTION

An attractive smile, with perfectly aligned teeth and the right balance of pink to white, is intrinsic to facial aesthetics. A slight discrepancy in the proportions of these elements could mar facial appeal overall. This has prompted a surge in the demand for facial aesthetic enhancement procedures. One such concern is that of a 'gummy smile,' a condition where visible gingival display exceeds the cosmetically acceptable dimensions of 2-3 mms.

Presence of a short upper lip, prominent anterior dento-alveolar apparatus, vertical maxillary excess and altered passive eruption have generally been attributed to the development of this condition. Treatment modalities advocated for excessive gingival display have been diverse ranging from crown lengthening, orthodontic intrusion, restorative dentistry and surgical techniques such as lip elongation, myotomy or injection of botulinum toxin.

Crown lengthening is usually indicated for patients with short clinical crowns, due to passive eruption (1). Orthognathic procedures are extensive and associated with significant discomfort. Alternatively, the effect of botulinum toxin is for a short-term, about 3 to 6 months, requiring repetition of the procedure for maintaining the clinical outcome (2).

The earliest reference of a cosmetic surgical alternative is the 'lip repositioning' technique by

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Fig. 1. Pre-operative image showing excessive gingival display in a female patient

Fig. 2. Line of incision marked using disclosing agent

Rubenstein and Kostianovsky, in 1973 (3). The procedure has also been referred to as 'mucosal coronally positioned flap' (MCPF) and consists of removal of a section of mucosa from the maxillary vestibule. Subsequently, the lip mucosa is coronally positioned and sutured to the mucogingival line. The outcome is a shallow vestibule with reduced gingival display during smiling, and therefore is also termed 'reverse vestibuloplasty'. Ambrosio *et al.*, in 2018 noted stability of the surgical lip repositioning seen in two patients followed up for two years (4).

Although there were many case reports, clinical studies evaluating the efficacy of this mode of treatment are scarce. Hence, the aim of this study was to evaluate the clinical efficacy of the MCPF procedure in correcting excessive gingival display, over a period of 3 months.

MATERIAL AND METHODS

Eight systemically healthy patients, above 18 years of age, were recruited from the patients who presented to the Department of Periodontics, for aesthetic concerns regarding their smile and 'gum display.' Permission to conduct the study was obtained from institutional ethics committee (14.05.2014; IEC/283/2014). The research was performed in accordance to the principles of Helsinki Declaration of 1975 (revised in 1983).

Presence of periodontally healthy maxillary anterior teeth, short or hyperactive upper lip (lip mobility >8 mm), gingival display greater than or equal to 4 mm during smiling, vertical maxillary excess - Grade 1 (2-4 mm) and Grade 2 (4-8 mm) were the inclusion criteria. The patients with periodontitis, parafunctional habits, grade 3 vertical maxillary excess (> 8mm), systemic conditions such bleeding disorders, uncontrolled diabetes, those on anticoagulant therapy and pregnant and lactating women were excluded from the study.

Clinical parameters:

All patients were initially asked about the extent of gum exposure as mild, moderate or severe. Clinical assessment of oral hygiene status and gingival health were carried out using the Plaque Index, Gingival Index, and modified Sulcular Bleeding Index at baseline and 3 months. The aesthetic parameters recorded include measurements for the smile line, upper lip length, upper lip vermillion length, distance between the lips and amount of gingival display at baseline, 15 days and 3 months. All the measurements were made by single trained and calibrated examiner using digital Vernier calipers.

The smile line was determined as high, optimal or low by observing the patient's smile. A high smile/lip line usually displays the entire clinical crown with exposure of the gingiva, while the low smile line displays less than three-quarters of the maxillary anterior teeth. When the upper lip reaches the gingival margin, with display of the maxillary central incisors and the interproximal gingivae, it is considered an optimal smile.

Upper lip length was measured from the subnasale to the inferior border of the upper lip. Upper lip vermilion length was measured from the superior border of the upper lip to the inferior border of the upper lip at midline. Incompetency of lips was noted by assessing distance between the lips. The amount of gingival display was measured from the inferior border of the upper lip vermilion to the gingival margin of the central incisor during active smiling (Figure 1).

Oral prophylaxis was carried out, following which, the patients were advised to report for surgical correction of excessive gingival display after

Fig. 3. Partial thickness flap removed

Fig. 4. Mucosal coronally positioned flap and sutures placed

a week, with emphasis on plaque control measures during this period.

A single clinician was assigned to carry out the surgical procedure for all the patients. The procedure was previously performed on other patients to achieve a sufficient degree of proficiency before starting the clinical study.

Following anaesthesia, the line of the first incision was marked using a two-tone disclosing agent (ALPHA PLAC, DPI, Mumbai, India) with a periodontal probe placed about 1mm apical to the mucogingival junction from the distal aspect of the upper second premolar on one side to the distal aspect of the upper second premolar on the other side. Taking the measurement of double the length of gingival exposure, a second line was drawn from the line of the first incision into the vestibule from premolar to premolar, converging smoothly over the first line in the distal aspect (Figure 2). A partial thickness flap was removed to expose the connective tissue between the incision lines (Figure 3). Haemostasis was achieved with the help of compression of surgical site. Subsequently, the second incision-line was coronally advanced and sutured to the first incision-line. To prevent shifting of the midline, an interrupted suture was given in the midline. Two additional interrupted sutures were given on the distal aspect of the incisions bilaterally, followed by placement of continuous sutures in between, to ensure closure of wound (Figure 4).

The patients were advised to use Charter's method of tooth brushing along with Chlorhexidine mouthwash, 0.2% twice daily (Hexidine 0.2%, ICPALAB, Mumbai, India) for two weeks, to obtain effective plaque control. Ibuprofen, 400 mg (Brufen, Abbott Laboratories, Illinois, USA) twice daily for three days, was advised for pain relief. Following suture removal, patients were interviewed regarding perception of treatment. All patients were re-evaluated at 15 days and 3 months post-operatively for clinical and aesthetic parameters, along with an assessment of their overall satisfaction.

Statistical analysis

Data was analysed using SPSS version 18 (SPSS Inc. Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc). A p-value of <0.05 was considered statistically significant. Comparison of mean values from baseline through 3 months was done using paired t test, Repeated measures ANOVA with post-hoc Bonferroni test.

RESULTS

Eight patients i.e., 6 females and 2 males, aged between 22 to 28 years were recruited for the MCPF procedure. Clinical parameters of assessment were carried out at baseline, at fifteen days and at three months.

Clinical Indices

There were no significant differences in the mean clinical index scores of Plaque index (P=0.946), Gingival index (P=0.704) and modified Sulcular bleeding index (P=0.067) between baseline and 3 months post-operatively (Table 1).

Aesthetic parameters

Smile line

High *smile line* was observed in all the patients.

Upper lip length

There was significant difference in the mean upper lip length from baseline measurements through 3 months (P=0.019). Post hoc test showed that there was significant decrease in mean upper lip length from 15 days to 3 months (Table 2).

Upper Lip Vermillion length

There was no significant difference in the mean upper lip vermillion length from baseline measurements through 3 months (Table 2).

Distance between the lips

There was a significant difference in the mean distance between the lips from baseline measurements through 3 months (P=0.013). Post hoc test showed that there was significant decrease in mean distance between the lips from baseline to 3 months post-operative measurements (Table 2).

Gingival display

There was significant difference in the mean distance between gingival display from baseline measurements through 3 months (P<0.001). Post hoc test showed that there was significant decrease in mean gingival display value at 15 and 3 months when compared to baseline values (Table 2).

Survey

About half the number of patients reported moderate gum exposure, while the others reported severe gum exposure. During the initial post-operative period, one patient complained of severe discomfort, 4 complained of minimal discomfort, 2 patients had moderate discomfort, while 1 patient experienced no discomfort. All 8 patients experienced difficulty in speaking and tightness of the lip, while one patient complained of dryness of the mouth. There were no complaints of drooling of saliva. When the patients were questioned about their satisfaction with their smiles 3 months post-operatively, 1 patient seemed satisfied, 5 were extremely happy, while 2 were willing to recommend the procedure to others. Three months post-operatively, on being asked about the perception of smile by other people, one patient said others perceived no change, three patients said others found it satisfactory and four of the patients indicated that others perceived that their smile looked better.

DISCUSSION

The MCPF procedure was relatively easy to perform with adequate haemostasis achieved following suture placement. Clinical indices did not change considerably at three months recall, indicating that the procedure did not hamper maintenance of oral hygiene (Table 1). Patients were able to perform adequate oral hygiene procedures, which were re-inforced at every recall visit.

Fig. 5. Three months post-operative image shows reduction in the gingival display thereby improving the smile of the patient

The amount of visibility of the periodontium depends on the position of the smile line. In the present study, the smile line tended to be mostly 1 mm above gingival margin and could be considered as high. Low smile lines have been found by Peck et al and Tjan and Miller to be predominantly a male feature, while a high smile line is considered predominantly female (5-7). It may be noted that there were more female patients in the present study.

In the present study, an increase in the upper lip length was observed post operatively, attributable to inflammation, which has also been noted in previous studies (7). However, at three months, not much change from the baseline measurements could be appreciated. Therefore, the procedure did not bring about changes in upper lip length dimensions.

Similarly, Roe *et al.* observe that during maximum smiling, there is a decrease in the upper lip length between groups with short and normal upper lip. This did not affect the dento-gingival exposure

Table 1. Comparison of Clinical indices (Plaque Index, Gingival Index and modified Sulcular bleeding Index) at baseline and 3 months

	Baseline Mean±SD	3 months Mean±SD	P-value
Plaque index	1.24±0.39	1.24±0.36	0.946
Gingival index	1.27±0.38	1.25±0.37	0.704
Modified sulcular bleeding index	1.32±0.39	1.27±0.38	0.067

Table 2. Comparison of Aesthetic parameters (Upper Lip Length, Vermillion length, Distance between lips and Gingival Display) baseline, at 15 days and at 3 months

Parameter	Baseline [B] Mean±SD	15 days [15] Mean±SD	3 months [90] Mean±SD	P-value	Post hoc test
Upper Lip Length	20.32±3.47	21.21±3.73	20.21±4.01	0.019	90>15
Vermillion length	8.39±0.83	8.53±0.96	8.37±0.95	0.889	-
Distance Between Lips	3.87±3.15	2.82±2.56	3.05±2.77	0.013	B>15
Gingival Display	5.28±1.06	1.31±1.48	2.63±0.52	<0.001	B>15, 90

Repeated Measures ANOVA with post-hoc Bonferroni test

(8). In contrast, Peck *et al.*, 1992 report increased upper lip length in cases with excessive gingival display (6). They opined that the association of factors such as higher muscle capacity, vertical maxillary excess, excessive inter-labial gap at rest, and the amount of overjet and overbite have a greater effect on the gingival display than the upper lip length itself.

It can be seen that there was no significant change in the baseline and post-operative dimensions of upper lip vermillion length (Table 2). Therefore, vermillion length also did not alter considerably following this MCPF procedure, thereby preserving aesthetics. This is unlike the findings of Iqbal et al, where a 2 mm increase in the vermillion length was observed at the third and sixth month (9).

The distance between the lips, increased from the fifteen day dimensions by three months. Clinically, there was reduction of the distance between the lips compared to the distance at baseline, although not statistically significant (Table 2). During the initial post-operative period, there was an increase in the upper lip length, which contributed to the decrease of the distance between the lips. As the upper lip reverts gradually to its original position over time, the distance between the lips also seems to increase. Hence, the procedure did not bring about closure of the distance between the lips.

A significant reduction in the gingival display was observed at three months (Table 2) (Figure 5). This change may be ascribed to the decrease in the depth of the vestibule by coronal repositioning of maxillary labial mucosa and restriction of the lip muscle pull, by suturing. Silva *et al.* made similar observations in thirteen patients treated with modified lip repositioning. The initial gingival display of 5.8±2.1 mm decreased considerably to 1.4±1.0 mm at 3 months and at 6 months to 1.3±1.6 mm (10). A systematic review by Tawfik *et al.*in 2017 suggested that lip repositioning successfully improved excessive gingival display by 3.4 mm (11).

Case reports have shown improvement in gingival display with stability of obtained results, though no standard measurements of clinical parameters were carried out. Ramesh *et al.*, 2019, followed up lip repositioning surgery in a series of three cases and found no relapse when observed over two years (12).

From the satisfaction survey, it was evident that most patients were generally content with the outcome of the procedure, with no adverse events noted. However, post-operative pain, discomfort and tightness of the lips were observed in almost all cases. The survey also indicated that the gingival display correction obtained by modified coronally positioned flap procedure was well-accepted and did not alter patient appearance significantly.

The present clinical study is one of the very few where this procedure has been evaluated in detail over a long term of assessment and in several patients. This study evaluated the clinical efficacy of this gingival aesthetic enhancement technique systematically over a period of three months. It may be seen that the modified coronally positioned flap resulted in satisfactory correction of gingival display, producing no alteration in facial appearance. The procedure creates a shallow vestibule while restricting the pull of the lip musculature, thus obscuring the excessive gingival display on smiling.

Several clinicians have attempted to enhance the gingival display correction utilizing a combination of methods such as surgical crown lengthening, laser-assisted crown lengthening, administration of botulinum toxin along etc. with lip repositioning surgery (13). It is implied that adequate case selection and treatment planning will determine selection of the appropriate method or combination of methods, on a case to case basis (14).

The simplicity of the technique, ease of operation, enhanced accessibility along with immediately perceptible changes are some of the advantages noted with this surgical technique. Hence, the procedure may be recommended for patients with excessive gingival display that is not complicated by delayed passive eruption or skeletal aberrations. However, it cannot be advocated to achieve closure of incompetent lips, as the present study did not result in any change in the distance between the lips (15).

CONCLUSION

The present study provides conclusive evidence that the mucosal coronally positioned flap procedure performed for correction of excessive gingival display showed acceptable improvement from both the clinician and patient perspective. All the patients showed uneventful healing with an improved smile. Future studies are needed to evaluate the stability and oral health related quality of life.

STATEMENT OF CONFLICT OF INTEREST

The authors state no conflict of interest.

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