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Case Report

Modified Lip Repositioning Technique with Elevator Muscles Ligation by Innovate Suture Material: A Case Report with 5 Years Follow Up

Soulafa Mohamed Belal*

BDS, MSc in Periodontology, Oral Medicine, Oral Diagnosis and Oral Radiology, Faculty of dentistry, Tanta University, Egypt

***Corresponding Author:** Soulafa Mohamed Belal, BDS, MSc in Periodontology, Oral Medicine, Oral Diagnosis and Oral Radiology, Faculty of dentistry, Tanta University, Egypt.

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Abstract

Aim: To evaluate using modified type of suture material for elevator muscles containment and its long term effect.

Methods: 23 years old patient had been enrolled at this study, requiring management of her excessive gingival display (EGD) during smiling. The causes of her problem were altered passive eruption and hypermobile lip. An esthetic crown lengthening surgery was carried out first and after 3 months we performed the modified surgical lip repositioning technique, with elevator muscle containment using polytetrafluoroethylene (PTFE) suture material. Patient was followed up 3 weeks, 12 months, 3 and 5 years post-surgical.

Results: At early stage of follow-up the main complaints of patient were the feeling of tension in the upper lip and mild pain which was managed with analgesics. One month postoperatively, the gingival display was recorded to be between 0 and 1 mm, by time (after 1 year) it becomes 1 - 2 mm and still stable up to 5 years. Patient satisfaction records after 1, 3 and 5 years of follow up was satisfied with the result.

Conclusion: This case report presents an innovative and effective therapeutic option to obtain a natural and harmonious smile. The patient expressed a high degree of satisfaction.

Keywords: *Gummy Smile; Hypermobile Lip; Altered Passive Eruption; Elevator Muscles Containment; Suturing; PTFE*

Introduction

Smiling is a powerful social communication mean that expresses joy and happiness regardless of the language and race of the person. For this reason, it is an important concern for people that their smile is not ideal. In order to have an ideal smile, all anatomical structures, such as the lips framework, gingiva scaffold, teeth, and jaws, must be in harmony [1]. The frame of the smile is formed by the lips, which had been classified into high, medium and low smile line. The high lip line is significantly prevalent in women and present an esthetic challenge for most of dentists to achieve perfect smile appearance [2].

Although slight gingival display express more youthful smile, gingival display of 4 mm or more is considered to be unattractive by the dentists and patients which is defined as excessive gingival display (EGD) or what is commonly known as gummy smile [3].

To manage correctly such condition, a cleaver dentist should define the cause(s) of his patient's gummy smile, as there are five common causes that may lead to gummy smile. The causes are: vertical maxillary excess (VME, skeletal cause), dento-alveolar cause, short upper lip

cause, hypermobile lip (muscular cause) and dento-gingival cause (altered passive eruption). Each cause has its own way of treatment; otherwise unpredictable results will be gained. Also, each gummy smile case may have more than one cause behind it, so it is important to precisely define which cause(s) is/are present [4].

Surgical lip repositioning is considered one of the suggested techniques to manage the EGD condition caused by short upper lip or hypermobile lip. In 1973, the lip repositioning procedure to treat EGD was described by Rubinstein and Kostianovsky [5], followed by case reports by Litton and Fournier [6], Miskinyar, and Robbins [7]. Shreyas., *et al*. found that a total of 105 articles on the subject were published in a 10-year literature review on the use of lip repositioning surgery in the treatment of EGD [8]. As can be seen, more studies on lip repositioning surgery are needed. The main concept behind it, which was made for the first introduction of the technique is to control the elevator muscles activity through shallowing or shortening the vestibular depth by removing 10 - 12 mm in height of epithelial band of alveolar mucosa, starting from muco-gingival junction (MGJ) to upward and then suturing the upper incision line to the lower one (MGJ). This will limit the activity of the upper lip elevator muscles, which lead to limit its power of contraction causing decrease lip elevation by time, so manage or decrease the EGD condition [9].

Although the idea and the technique usually succeeded at first (at least the first 6 months post-surgical), but relapse liability, either partial or full relapse sometimes occurs. So, some modified techniques had been introduced in addition to the original technique, by adding additional step in order to prevent or decrease the relapse liability [10-13].

One of latest techniques is the surgical lip repositioning with elevator muscle ligation or containment. It was introduced since 2014 by multiple articles in form of case reports, case series and randomized controlled trials [14-16]. All studies evaluated patient satisfaction, and the participants were willing to recommend the procedure to a relative/friend. The study of Al Jasser., *et al*. [17] showed that patient satisfaction scores were significantly improved up to 36 months. Patients showed minimal discomfort and scar formation in the other study [18]. At baseline, the mean EGD was 6.36 mm [18] and 6.9 mm [17]. Six months after the surgical procedure, the mean EGD was 0.76 mm [18] and 1.7 mm [17]. After 12 months, the mean EGD was 0.72 mm [18] and 2.0 mm [17], respectively, and at three years, the mean gingival display was 3.5 mm [17,19].

The common step in all published papers is the muscle ligation was done by resorbable suture material [17-19]. In our case report, we decided to use non-resorbable suture material, in order to prevent or decrease the liability or percentage of relapse. The chosen material at our case report was polytetrafluoroethylene (PTFE). The reason why we select such material was it is one of the monofilament suture material that is used in internal suturing for non-oral surgeries (as neurovascular surgery) safely [20]. In addition, PTFE is biologically inert [21] and less likely to cause inflammation [22,23]. Finally, as a monofilament material, it is less prone to infection [24] shows minimal distortion after knotting and minimal elongation upon linear traction [25]. As a dual benefit, the knot is less of a breaking point and the risk of gapping is minimized [26]. Using a non-resorbable suture material was used in order to gain more stable result on the long term.

Case Report

23 years old female, medically free, non-smoker was complaining from gummy smile condition. She was asking for improving her esthetic condition by managing the EGD during smiling. Upon examination it was found that she is suffering from EGD due to both dento-gingival cause (altered passive eruption) and hypermobile lip activity (Figure 1 and 2). Her gingival display was clinically measured at Duchene smile and it was recorded to be 8 mm (Figure 3). First step to treat her condition was through managing the dento-gingival cause through esthetic crown lengthening. After 3 months of this procedure, there was little improvement of her smile (the gingival display during Duchene smile became 5 mm (Figure 4-6). She wasn't satisfied with the result so with her, we decided to complete the management of the other cause (the hypermobile lip) through surgical lip repositioning technique with elevator muscle containment using PTFE suture material.

Figure 1: *Pre-operative clinical condition during Duchene smile (facial view).*

Figure 2: *Pre-operative clinical condition during Duchene smile (profile view).*

Figure 3: *Measurement of the gingival display during Duchene smile, it was 8 mm.*

Figure 4: *After esthetic crown lengthening, little improvement of the EGD (facial view).*

Figure 5: *After esthetic crown lengthening, little improvement of the EGD (proximal view).*

Figure 6: *After 3 months from esthetic crown lengthening, the gingival display recorded 5 mm.*

The surgical steps

After giving the patient the local anesthesia, the epithelial band which planned to be removed had been decided according to patient smile width (from first molar at right side to first molar at left side), the height of the band to be removed was 12 mm (calculated by measuring the gingival display during smiling, which was 5 mm and then was duplicated and with additional 2 mm too. The thickness of the epithelial band to be removed was 1 mm or less.

Two parallel lines, one at the MGJ location and the other superior to it by 12mm were drawn and connected at the first molars bilaterally by round lines, to facilitate the closure and approximation at the incision lines ends during suturing to decrease the tension that may annoy the patient later. Using blade No. 15, the incision was carried out in a superficial level at the drawing lines, followed by very superficial splitting of the alveolar mucosa tissue (Figure 7).

Figure 7: *After epithelial band removal, exposing the underlying connective tissue.*

After that, elevator muscles ligation or suturing was carried out using 3/0 PTFE suture material, with the connective tissue above it and the periosteum below. The elevator muscles are known to be located from mid-canine right to mid-canine left, so there is no necessity to expose the muscle be removing or incise the connective tissue layer to be directly sutured, as we try to be minimally invasive as much as we can. Starting suturing the muscle midway at the exposed area apico-coronally, taking a deep horizontal bite (reaching the periosteum) of 4 - 6 mm width, making a tight knot. Beside the first knot, we did a second one with the same concept. A third one usually be done, but be sure you didn't exceed the mid-canine at both sides (Figure 8). The sutures were done at both right and left side (3 at each side) then final closure to approximate the two incision lines, reposition the lip at new level (the suture done at MGJ level), using 4/0 polyprolene suture martial, through continues with lock suture technique (Figure 9).

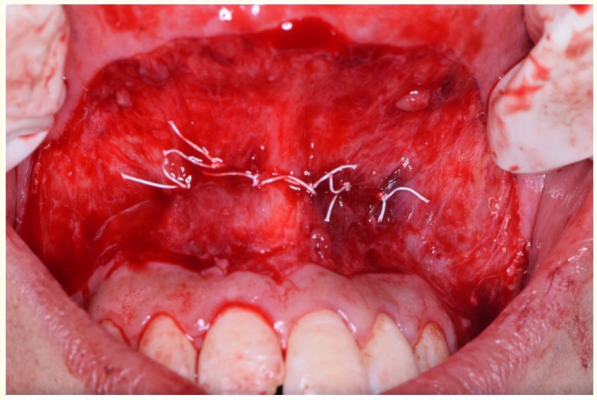

Figure 8: *Elevator muscles containment or ligation, using PTFE suture material.*

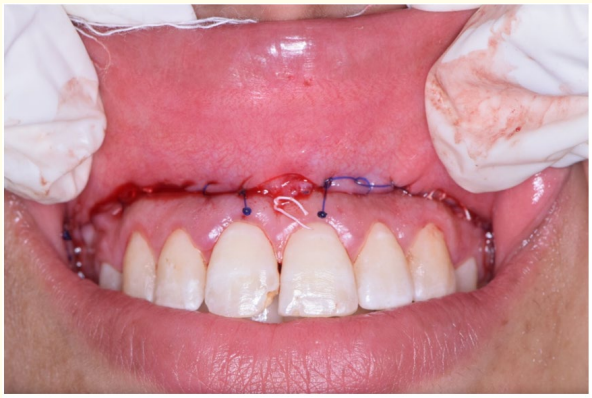

Figure 9: *Lip repositioning through suturing the two incision lines, using prolene suture 4/0.*

Post-surgical instructions were given to the patient, specially to limit the wide smiling during the initial healing period. Medications were prescribed for the patient (pain killer, anti-edematous, therapeutic mouth wash). The suture removal appointment was scheduled to be 3 weeks post-surgical.

Follow up after suture removal was decided to be every 6 months.

Results

An uneventful recovery was seen 3 weeks after surgery (Figure 10-12). The patient reported tension in her upper lip when she smiled 1 week after surgery, but she noticed that it decreased by time (she started to be adapted to it). Three weeks later, the sutures were removed (Postoperative healing occurred with minimal discomfort). Since the suture line was hidden in the upper lip mucosa, uneventful healing was seen with a scar that was not visible when the patient smiled. Twelve months later, the patient's EGD appearance was reduced (Figure 13 and 14). A stable result was obtained after 3 years of follow-up (Figure 15 and 16). Minor relapse had been occurred through years, reaching 2 - 3 mm after 5 years post-surgical (Figure 17 and 18).

Figure 10: *After 3 weeks post-surgical (facial view).*

Figure 11: *After 3 weeks post-surgical (proximal view).*

Figure 12: *After 3 weeks post-surgical (before suture removal, showing healing).*

Figure 13: *After 12 months post-surgical (facial view).*

Figure 14: *After 12 months post-surgical (proximal view).*

Figure 15: *After 3 years post-surgical (facial view).*

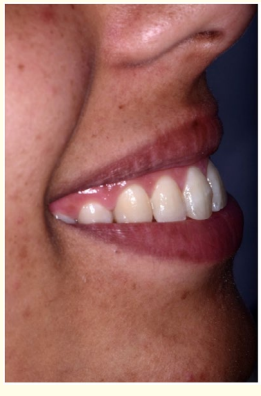

Figure 16: *After 3 years post-surgical (proximal view).*

Figure 17: *After 5 years post-surgical (facial view).*

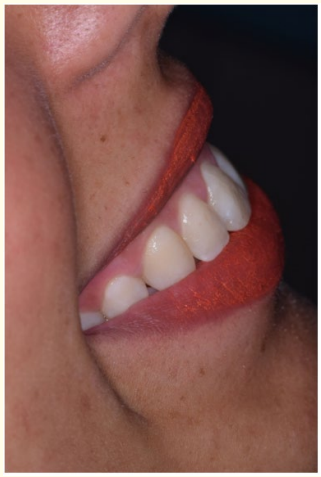

Figure 18: *After 5 years post-surgical (proximal view).*

Discussion

One of the important targets of periodontal plastic surgery is to create ideal esthetics for the patient's smile. For these challenging patients, a multidisciplinary approach usually is required to enhance the balance and harmony between all three components of the smile (the teeth, lip framework, and the gingival scaffold) [1]. Excessive gingival display (EGD), famously known as gummy smile, is the term used when there is an extra-exposure of maxillary gingiva during smiling [3]. The incidence of EGD is usually associated with different causes such as altered passive eruption, anterior dento-alveolar problems, vertical maxillary excess, and short and hyperactive upper lip. To establish an appropriate treatment plan, identifying the etiology of the EGD and an accurate diagnosis are necessary [4].

Surgical lip repositioning is a suggested treatment modality for patients with EGD associated with hypermobile upper lip. The aim of surgical lip repositioning is to shallowing the vestibule and limit the contraction of the upper lip elevator muscles by removing a strip of mucosa from the maxillary buccal vestibule and attaching the lip mucosa to the mucogingival line, leading to reducing the gingival display at smiling [9].

One of the latest modification of surgical lip reposition is combining the basic technique with elevator muscles containment. The hypothesis was that utilizing deep periosteal sutures to limit the contractility power of the muscles at time of the critical period of initial healing, as by time suture of the muscles will resorb, a stable and strong scar tissue shall be formed to prevent or decrees relapse percentage [14,15].

In a recent systematic review and meta-analysis [19], they found that surgical lip repositioning with muscle containment with sutures reported reductions in EGD of 2.43 mm and 2.35 mm at six and 12 months, respectively [27,28]. A longer prospective study was conducted with 3 years follow up with the patients showed a clinically significant difference in the stability of the outcome variables. Within the limitations of this study (small sample size), the results indicated that the effects of this modification can persist for up to 3 years after the initial surgery [29]. Therefore, establishing a technique that develops almost no relapse remains a challenge.

In our study we modified the technique by using a PTFE non-resorbable suture material, in order to maintain long lasting stable result. By following up the patient for 5 years, it had been showed that there is maintenance of satisfied and stable result, in spite of the minor relapse of the result which had been occurred after the first year (1 - 2 mm). No clinical problems or complications had been reported by the patient due to utilizing such biocompatible suture material. Further studies are recommended to be conducted with large sample size of patients and may be with other non-resorbable suture materials such as polyprolene or nylon for muscles ligation or containment, as it is much more cost effective than PTFE suture material.

Conclusion

This case report demonstrates the successful treatment of EGD through lip repositioning with muscle ligation, using PTFE non-resorbable suture material. At 6-month follow-up, our results appear to be stable, and continue in its stability with minor relapse through years (up to 5 years). Appropriate case selection is considered to be critical to the success of the surgical procedure. Long-term follow-up studies and randomized controlled trials are needed to evaluate the stability and efficacy of this method. Also using different non-resorbable suture materials for the same technique, being more price affordable than PTFE is recommended.

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