Original Article

A Comparative Clinical Study Between Crestal Incision Approach And Kazanjian Vestibuloplasty During Ridge Augmentation For An Atrophied Posterior Mandible Using Nanobone Block

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ABSTRACT

Purpose: The aim of this study was evaluating and compare the clinical outcome of bone block ridge augmentation using two flap designs approach, crestal incision and Kazanjian vestibuloplsty.

Materials and Methods: 20 patients with age range 35- 55 years will be included in this study; all patients selected for this study require bone augmentation procedures because of severe alveolar ridge atrophy in posterior mandible with standing anterior teeth. Patients will be divided randomly in to two groups of 10 patients. Group A will be scheduled for ridge augmentation using Kazanjian vestibuloplasty incision approach and group B will be scheduled for ridge augmentation using crystal incision.

Results: This study demonstrated that the use of Kazanjian vestibuloplasty resulted in significant increases in ridge width and height. In group A the amount of bone height gained was 2.25 ± 1.31 mm ($P < 0.001$) and bone width gain was 2.3 ± 1.49 mm ($P < 0.002$), while in group B the amount of bone height gained was 0.75 ± 0.97 mm ($P < 0.001$) and bone width gain was 0.45 ± 0.55 mm ($P < 0.002$).

Conclusion: In posterior mandible reconstruction, bone grafts increase the number, length, and diameter of implants that can be placed. The use of Kazanjian vestibuloplasty is better than crestal incision as an approach during ridge augmentationn using Nanobone block.

Recommendation: More attention to detail and meticulous technique may prevent the progression of complications to Nanbone block graft failures.

Key Words: Ceatal incision, kazanjian vestibuloplasty, nanobone block, ridge augmentation

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INTRODUCTION

Insufficient height and width of alveolar bone affects the success of dental implants placement with regards to maintain an ideal pathway and avoid important anatomical structures, and creates aesthetic and hygienic maintenance problems. Vertical and/or horizontal ridge augmentation may be mandatory using various bone materials and bone regeneration procedures[1]. Guided bone regeneration with bone blocks substitute leads to higher ridge dimensions with most favorable outcomes in hard and soft tissue contours[2]. Imaging, preoperative planning and careful surgical technique especially flap advancement may prevent guided bone regeneration complications[3]. Alveolar localized defect correction with an increase in the volume and quality of the peri-implant soft tissue improves aesthetic and hygienic maintenance. Various flap designs affect the complications of healing and the stability of the soft tissue during implant-prosthesis rehabilitation. Also bone regeneration in oral surgery has been affected by uneventful soft tissue healing after primary closure of augmented sites[4,5]. Considering these aspects, the present study aims to investigate and compare the outcomes of crestal incision versus Kazanjian vestibulopasty flap designs on posterior alveolar ridge augmentation using bone blocks.

PATIENTS AND METHODS

Subject selection: Twenty patients with partial edentulism in the posterior mandible were selected for the present study. They all showed sever alveolar ridge atrophy, which required bone block augmentation.

The participants were healthy and free from any systemic conditions that may complicate surgical procedures, bone formation, osseointegration or soft- tissue healing (such as immunological diseases, diabetes mellitus, pulmonary diseases, renal disease, cardiovascular diseases and blood diseases). Also patients with malignancy, hepatitis, drug abuse,

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chemotherapy, radiotherapy and smokers were excluded from this study.

All patients signed a written informed consent form. Patients were assigned equally and randomly into two groups; kazanjian vestibuloplasty approach was used in the first group, while crestal incision approach was used in the second group.

Flap design: Group A: under local anaesthesia, an intraoral Transmucosal curvilinear incision was performed on alveolar ridge at the junction of attached mucosa till periosteum. Careful sharp supra periosteal dissection of muscle and connective tissue attachments was carried out till the flap is large enough to cover the graft at the end of surgery. Bi-pedicled flap was elevated. The wound was irrigated with normal saline and local haemostasis was achieved. While, group B: Full thickness crestal incision was carried out and the soft tissue overlying atrophied ridge was reflected

Bone block fixation:After exposure of the bone surface, bone decortication using fine round bur. NanoBone® block (ARTOSS GmbH, Rostock, Germany) (5mm height, 5mm thickness and 10mm length) was adapted to the atrophied ridge then fixed using micro-plate and 2 screws (7mm length, 1.25mm diameter).

Flap suturing: Group A: The buccal periostium was sutured to the lingual flap, covering the bone block as a first layer of closure using horizontal mattress 3.0 silk sutures. The partial thickness buccal flap was sutured to the periostium as far as possible in the vestibule to prevent any relapse of muscle attachment and act as a second layer of closure over the graft material. While, Group B: The buccal and lingual flaps were approximated and sutured using interrupted suture

Post-operative care: Systemic oral antibiotics (1g Augmentin tablet twice daily for ten days) and oral non-steroidal anti-inflammatory drugs (400 mg Ibuprofen tablet twice daily for three days) were administered to both groups post-operatively.

The participants were advised to follow soft food diet for two weeks and appropriate oral hygiene routine combined with 0.2 % chlorhexidine digluconate mouthwash twice daily.

Sutures were removed seven to ten days after the surgical procedures. The participants were not permitted to use removable dentures. Radiographic assessment (panoramic tomogram and CT scan) was carried out after six months.

STATISTICAL ANALYSIS

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median.

RESULTS

Procedures to reconstruct posterior mandibular defects were performed in 20 patients (7 females and 13 males). The mean age of the patients was 42.7 years (range 32-49 years). Eight of the procedures were executed on the right side and 12 on the left side. The average operation time for a procedure was 87 min (range 74-118 min).

Clinical results and complications: Group A: No intraoperative complications during the allograft augmentation and no postoperative complications were observed after ridge augmentation, except for one case of infection (Figs. 8a and b).

Group B: The main intraoperative complication was fracture of the bone block during augmentation in one case because it was fragile and easily fractured. In addition, one block graft was completely exposed (30 days after surgery) and lost (Fig. 5). Other minor Postoperative complications with no sequelae were: incision line opening (one case, Fig. 1), small perforation of the mucosa over the grafted bone (two cases, Fig. 7), and graft infection (one case, Fig. 6). In addition to partial graft exposure (Fig. 2), screw exposure (Fig. 3) and screw loss (Fig. 4). Treatment was initiated as soon as possible. Necrotic soft tissue was removed, and the bone block was leveled with the soft tissue using a high-speed bur. The area was immediately and thoroughly irrigated with chlorhexidine. Patients were prescribed an additional oral antibiotics therapy and instructed to apply chlorhexidine gel over the affected area twice a day, as well as to refrain from chewing on the grafted site until mucosal healing was complete.

Both groups; the regenerated ridges healed uneventfully and no evidence of serious adverse local reactions, that is, foreign-body reaction, pain, dysaesthesia, inflammation was observed in any patient throughout the study period.

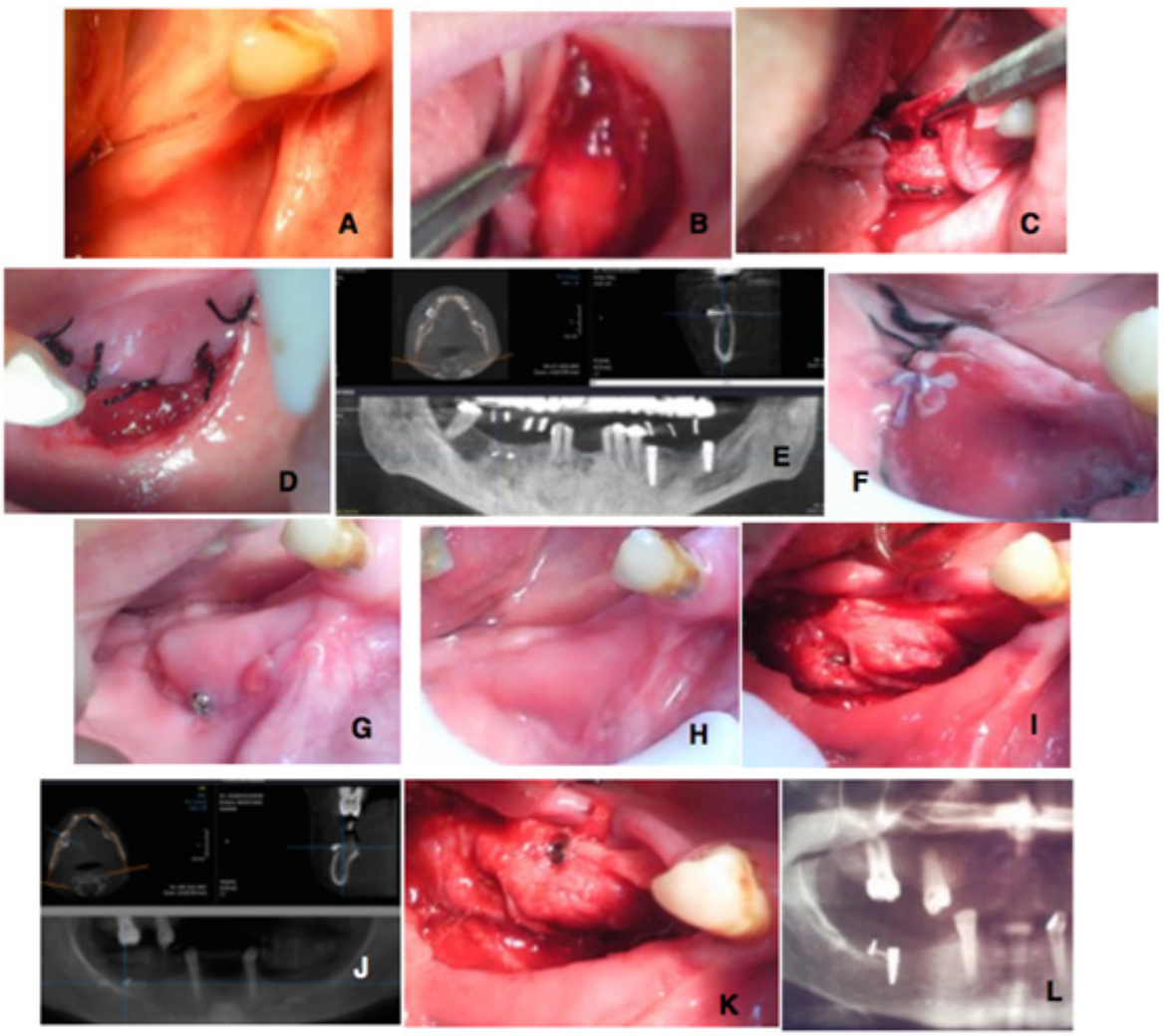

Fig.1:Ridge augmentation using Kazanjian vestibuloplasty.flap design:
Fig A: Showing thin ridge. **Fig.B:**Showing Kazanjian vestibuloplasty. **Fig.C:**Showing Nanobone block fixation. **Fig.D:** Suturing of Kazanjian vestibuloplasty.. **Fig.E:** Showing CBCT after ridge augmentation. **Fig.F:** Showing healing one week after surgery. **Fig.G:**Showing one month after surgery. **Fig.H:** Showing six months after surgery. **Fig.I:** Showing new formed bone. **Fig.J:** Showing CBCT after Nanobone block augmentation. **Fig.K:**Showing new formed bone and implant placement. **Fig.L**: Showing CBCT six months after Nanobone block augmentation and implant placement.

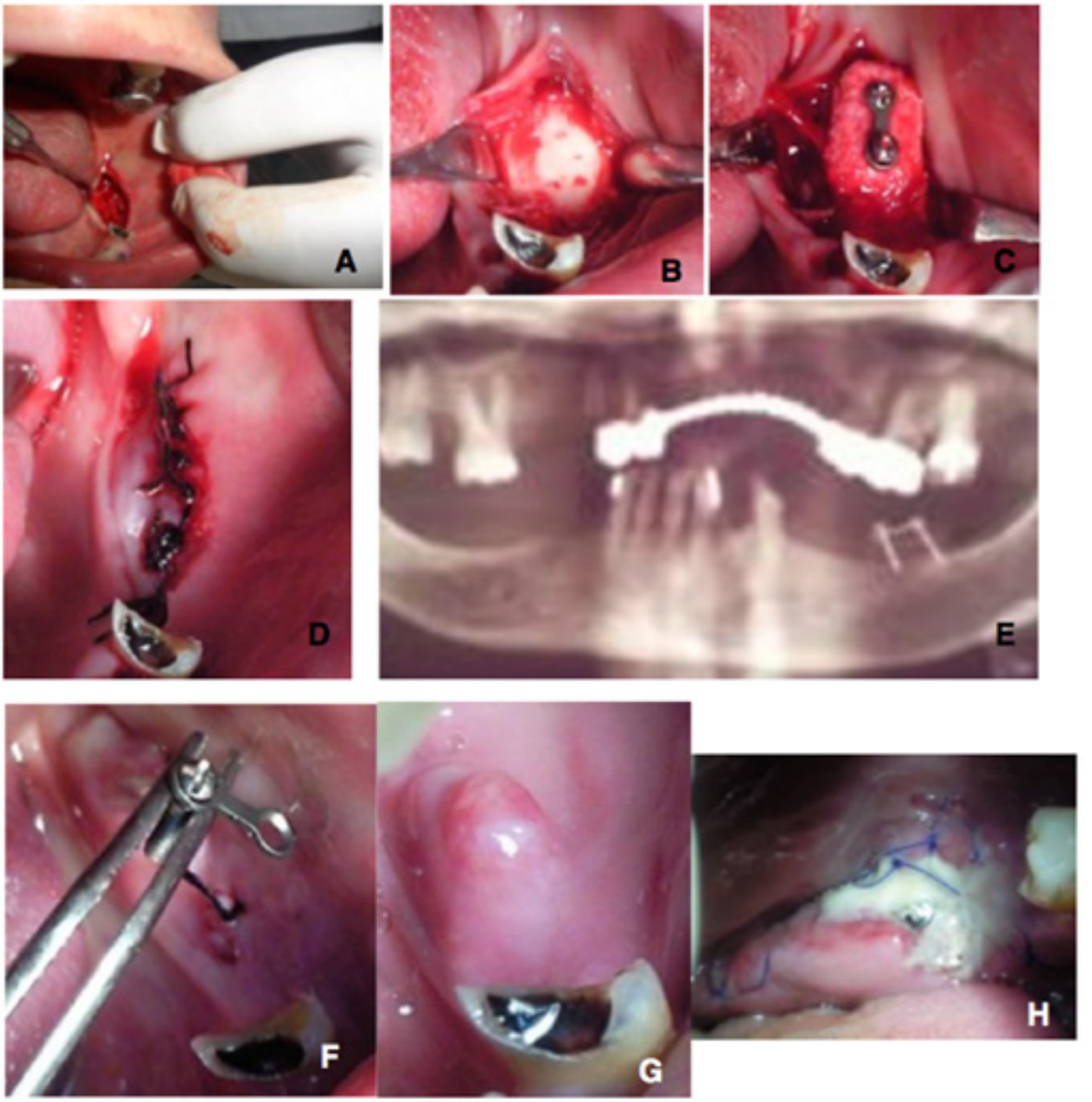

Fig.2:Ridge augmentation using crestal incision flap design:
Fig A: Showing crestal incision flap design. **Fig.B:** Showing cortical perforation. **Fig.C:**Showing Nanobone block fixation. **Fig.D:** Showing suturing. **Fig.E:** Panoramic x ray after ridge augmentation. **Fig.F:** Showing loss of fixation. **Fig.G:**Showing inflammation of the augmentation. **Fig.H:** Showing loss of the augmentation.

Radiographic results:

Alveolar bone height: Table 1 showed the mean alveolar bone height at baseline and 6 months after ridge augmentationin of both groups. It was found that the mean alveolar bone height of kazanjian vestibuloplasty group and crestal incision group at baseline was 8.2±2.46 and 9.9±2.28 respectively.

In kazanjian vestibuloplasty group, the mean gain of the alveolar bone height increased to 10.45±0.24 after 6 months that indicated a significant gain of the alveolar bone height as t-value was 1.88 ($p<0.05$).

In crestal incision group, the mean alveolar bone height increased to 10.7±2.49 after 6 months. This gain of the alveolar bone height was not statistically significant as T-value was 0.79 ($p>0.05$).

Comparing the gain of the alveolar bone height between kazanjian vestibuloplasty group and crestal incision group at 6 months after augmentation, statistical significant difference was noticed as Mann-Whitney Z-test was 0.89 ($p<0.05$).

Alveolar bone width: Table 2 showed the mean alveolar bone width at baseline and 6 months after ridge augmentationin of both groups. It was found that the mean alveolar bone width of kazanjian vestibuloplasty group and crestal incision group at baseline was 3.2±0.85 and 3.6±1.08 respectively.

In kazanjian vestibuloplasty group, the mean gain of the alveolar bone width increased to 6.7±1.76 after 6 months that indicated a significant gain of the alveolar bone width as t-value was 2.38 ($p<0.05$).

In crestal incision group, the mean alveolar bone width increased to 4.3±2.1 after 6 months. This gain of the alveolar bone width was not statistically significant as T-value was 1.44 ($p>0.05$).

Comparing the gain of the alveolar bone width between kazanjian vestibuloplasty group and crestal incision group at 6 months after augmentation, a statistical significant difference was noticed as Mann-Whitney Z-test was 0.43 ($p<0.05$).

Statistical analysis

The results of all measurements were registered on a record form and were entered into an electronic database to be analyzed statistically. The distributions of data were tested for normality. Comparison between measurements of bone in mm immediate and 6months postoperative done with paired t-test, these differences were statistically in significant ($p > 0.001$). whereas upon comparing the 2 groups Mann Whitney Z-test was used.

Table 1: Mean alveolar bone height (in mm) of kazanjian vestibuloplasty group and crestal incision group at baseline and 6 months after augmentation

Test period	Probing pocket depth (in mm)		M-Wt Z-test	*p-value*
	Group A X±SD	Group B X±SD		
Baseline	8.2 ±2.46	9.9±2.28		
6 months after augmentation	10.45±0.24	10.7±2.49	u=0.89	*p<0.05**
paried t-test	t=1.88 *P<0.05 **	t=0.79 *p>0.05* NS		

X±SD : Mean ± Standard deviation
M-WT Z-test : Mann Whitney Z-test
* : Statistical significant difference
NS : No statistical significant difference

Table 2: Mean alveolar bone width (in mm) of kazanjian vestibuloplasty group and crestal incision group at baseline and 6 months after augmentation

Test period	Probing pocket depth (in mm)		M-Wt Z-test	*p-value*
	Group A X±SD	Group B X±SD		
Baseline	3.4±0.85	3.6±1.08		
6 months after augmentation	6.7±1.76	4.3±2.1	u=0.43	*p<0.05**
paried t-test	t=2.38 *P<0.05**	t=1.44 *p>0.05* NS		

X±SD : Mean ± Standard deviation
M-WT Z-test : Mann Whitney Z-test
* : Statistical significant difference
NS : No statistical significant difference.

DISCUSSION

While many options exist for augmentation of an atrophic mandibular ridge, each varies in technical expertise needed and predictability of outcome. Ridge augmentations are traditionally performed using autogenous bone grafts for guided bone regeneration. The bone-harvesting procedure, however, is accompanied by considerable patient morbidity (eg, second-site pain, infection)[6].

When using an alternative, such as allograft, alloplast or xenograft, emphasis must be given to flap technique, perforation of the cortex to open the marrow cavity, stable placement of the graft(s), precise adaptation of the membranes, and stabilization, along with tension-free primary soft tissue closure[7].

In some cases, depending on the ridge area needing augmentation, the use of particulate with the addition of metal mesh or a nonresorbable titanium-reinforced membrane makes the procedure unnecessarily complex. These options may be outside of the skill set of the average clinician. Sometimes particulate bone alone, without additional support, will fail to hold the area as predicted[8].

In the present study, in order to offer our patients a less invasive surgery, a biomaterial has been compared to autologous bone and the difference in newly formed bone percentages was not statistically significant. During the histomorphometric evaluation, the percentage of newly formed bone was found to be lower in the test group; this meant a slower integration of the grafted material, which is not clinically appreciable; therefore, the use of autologous bone blocks does not seem to provide particular advantage[9].

NanoBone- by its chemical components- consists of very slow resorbing nanocrystal Hydroxyapatite embedded in a microporous Silicadioxide (SiO2)-matrix). NanoBone, showed high biocompatibility and high angiogenic response, thus improving the healing of bone defects and acts as a scaffold for bone regeneration[10].

This study is designed to evaluate how kazanjian vestibuloplasty technique may offer some advantages in the place of crestal incision technique in the treatment of atrophic posterior mandibles.

Clinical results revealed many postoperative complications in crestal incision group when compared to kazanjian vestibuloplasty group such as block graft exposure and loss, incision line opening, perforation of the mucosa over the bone block graft, graft infection, partial graft exposure, screw exposure and screw loss. These observations go with the studies of Gupta *et al.* 2010, Barbosa *et al.* 2008, Monteiro *et al.* 2000[14-16] who stated that kazanjian vestibuloplasty technique was known for high rate of clinical success, excellent predictability, long-term stability and this procedure was used to improve the stability of removable dentures or conventional optimized implant placement after ridge augmentation. Authors stated that this kazanjian vestibuloplasty achieved more predictable vertical bone gain, preserve the vestibular depth, maintain the keratinized gingival dimensions, and provide true tension-free closure.

Ponzoni *et al.* 2013[17] reported successful implementation of a kazanjian vestibuloplasty technique in the management of peri-implant soft-tissue deficiency and reported stable results in a prospective study. The authors observed that kazanjian vestibuloplasty technique retains some blood supply to the obtained graft. This simple technique is a very relevant and versatile tool and should be routinely employed in conjunction with block bone graft to augment severely atrophied ridge with minimal patient discomfort. On clinical examination, after 30 days, authors reported that the appearance of the mucosa sutured over the edge of the gums was inspected; however, it more resembled the buccal mucosa. Already the periosteum sutured over the lip presented with appearance and mobility similar to the labial mucosa with a line scar at the base of the groove created. Radiographic interpretation of alveolar bone level and width had been proven to be one of the most valuable means to clarify augmentation success. It had the advantages of being fast technique and of non-invasive nature[11]. As regarding the alveolar bone height and width, the present study showed that the use of kazanjian vestibuloplasty technique is successful and effective for the treatment of atrophic posterior mandibles than crestal incision technique. There was significant increase of the mean alveolar bone height and width at 6 months post-surgically in kazanjian vestibuloplasty technique. These results benefit from the better blood supply that can ultimately result in faster healing, lesser block graft shrinkage, and heightened chances of graft uptake. as reported by Jegham *et al.* (2005)[12]. The present study revealed a significant gain of bone dimensions upon using kazanjian vestibuloplasty when compared to crestal incision technique. This was in agreement with Restoy-Lozano *et al.* 2015[13] who concluded that Kazanjian technique is a simple procedure that can be performed under local anesthesia and provide satisfactory results, such as the depth of acceptable vestibule, decreased recurrence rate, absence of open area, less trauma, and edema with mild to good symptoms.

CONCLUSION

Kazanjian vestibuloplasty technique is better than crestal incision technique as an approach for bone block ridge augmentation in atrophied posterior mandible, this due to:

Kazanjian vestibuloplasty is a well tolerated surgical procedure, can be done under local anesthesia with satisfactory results.

Kazanjian vestibuloplasty provides adequate space to contain the bone block graft and allows suturing the flap without tension, this space is proportion with the bare tissue left in buccal mucosa.

Kazanjian vestibuloplasty completely covers the graft and the incision line is a way from the graft, this protecting the graft from the infection.

Unlike crestal incision flap, the lingual flap in Kazanjian vestibuloplasty is not completely dissected from the inner aspect of the mandible and maintains the vestibule. This decrease muscle tension preventing the movement on both sides of the wound preventing, the appearance of wound dehiscence and incision line opening. These are not a rare complication after crestal incision, due to muscle tension, which may compromise the prognosis of the underlying grafted bone.

The reason of incision line opening is more common in crestal incision bone block grafting because the overlying tissue must be advanced over a larger volume of bone and the tension on the incision line may be pull the soft tissue apart. In addition, the soft tissues are poor in local growth factor under the reflected flaps that lie over a graft material or barrier membrane, rather than the host bone

Complications were minimal compared to crestal incision technique

Adequate amount of sulcus depth can be achieved with minimal relapse with Kazanjian vestibuloplasty technique.

A marked improvement of alveolar ridge function in retention and stability was observed upon using Kazanjian vestibuloplasty.

CONFLICT OF INTEREST

There are no conflicts of interests.

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