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Use of an Impacted Post and Polyethylene Tube with Sutures as Fixation Methods during Vestibuloplasty Procedures

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Abstract

Background and Objectives: The purpose of this study was to clinically evaluate the efficacy of impacted post in terms of vestibular depth and relapse in comparison with polyethylene tubes with sutures as the fixation method in mandibular vestibuloplasty procedures. To avoid the need to use stents after mandibular vestibuloplasty procedures and eliminate the sharp "V" at the depth of newly created sulcus.

Methods: Ten patients with shallow mandibular labial sulcus (1-4 mm) an high mentalis muscle attachment were selected for this study. All the patients underwent Clarks' vestibuloplasty procedure. Five patients received impacted posts and other five-polyethylene tube with sutures as the fixation method for the apically positioned flap. Collagen membrane was used as the graft in all patients. All patients were reviewed at the end of 10 days, 1 month, and 3 months. Depth of the vestibule was recorded. Stents were not used in any of the patients. The measurements recorded were subjected to statistical analysis using independent Student't' test.

Results: A total gain of 7.11 mm (SD=.21) for polyethylene tube fixations group and 6.79 mm (SD=.50) was achieved at the end of 3rd month. Relapse percentage at the end of three months for polyethylene tube with sutures fixation method ranged between 16.6% and 28% with a mean of 22.684% (SD 5.046), and for impacted posts the relapse percentage ranged between 16.6%and 28.5% with a mean relapse of 22.959% (SD 7.797), on comparison p=.949 (p>.005) which is statistically not significant.

Interpretation and Conclusion: Both the methods of fixation yielded satisfactory results concerning the depth gained and relapse percentage. Need to use the stents was eliminated. There was no formation of sharp "V" at the newly created sulcus. Wound healing was uneventful. All the patients were comfortable and satisfied with their prosthesis.

Keywords: Vestibuloplasty; Relapse; Impacted Post; Polyethylene Tube; Collagen; Stents.

Introduction

Complete dentures are one of the most commonly used prosthesis. Providing complete dentures with optimum form and function is the primary aim of the dentist for the edentulous patients. A successful complete denture is both stable and retentive. It usually cannot be dislodged by normal function of the oral and circumoral musculature.[1] Ideally an adequate bone height with favorable soft tissue and favorable muscle attachments is desired. One of the many problems associated with the use of complete dentures is the loosening of lower dentures either immediately or after prolonged use, rendering the denture non-functional and non-esthetic. The cause of loosening of denture is gradual but progressive ridge resorption. Occasionally there is such a high degree of resorption of mandibular residual alveolar ridge due to prolonged use of prosthesis, long standing periodontal disease (diabetes mellitus, osteoporosis). These result in reduction in depth of sulcus, leads to higher attachment of paraoral musculature. The action of these muscles renders the prosthesis unstable and less retentive.[2] Inspite of the advances in the dental material sciences for prosthetic rehabilitation of edentulous mouth and a better understanding of oral physiology, there still remains a large number of individuals who are unhappy with their prosthesis, enduring functional shortcomings, speech difficulties and compromised appearance due to an incompatible oral environment.[3] There are two primary reasons for altering the soft tissues of denture seating area and allow deepening of the flange area, to provide increased resistance to displacement of denture and to provide stable soft tissue upon which the dentures can rest.[4]The secondary epithelialization Technique by Kazanjian 1935, has undergone many modifications over the years. As the wound created heals by re-epithelialization, 50% of the gained vestibular depth was lost during healing phase due to wound contracture and relapse.[5,6] This led to use of various graft materials like split thickness skin grafts [2,7] xenogenous fascial grafts,[8] palatal mucosal graft,[9,10,11] collagen membrane[3] etc.. There also have been various methods of retaining the apically positioned flap and reducing the relapse i.e., the use of surgical stents with circum-mandibular wire fixation during healing.[12] of concern with various Vestibuloplasty procedures is the sharp "V" that is created in the depth of the vestibule. This sharp "V" constitutes a problem for both, the prosthodontist and the patient.[3,14] Impacted posts have been used for the fixation of apically positioned flap after the Vestibuloplasty procedure.[15] A Polyethylene Tube can also be used for the fixation of the apically position flap, this also helps in eliminating the formation of sharp "V" at the depth of the vestibule.[14] Kollagen, which is a biological membrane, is used to cover the residual defect, which prevents wound contracture and avoids a second surgical site, as is the case with palatal or buccal mucosal[3]grafts. Therefore, in this study a comparison was made to evaluate the efficacy of impacted post and polyethylene tube with sutures for the fixation of the apically positioned flap after Clark's Vestibuloplasty procedure and the use of biological membrane (Kollagen) as the graft material.

Objectives

1. To clinically evaluate the efficacy of use of impacted Posts in terms of vestibular depth and relapse in comparison with Polyethylene Tubes with Sutures as the fixation methods in mandibular labial vestibuloplasty procedures.
2. To avoid the need to use stents after mandibular labial vestibuloplasty procedures.
3. To eliminate the sharp "V" at the depth of newly created sulcus.

Materials and Methods Source of Data

Out of the total number of edentulous patients requiring vestibuloplasty, referred by Department of Oral and Maxillofacial Surgery, Chhattisgarh Dental College Research Institute, Rajnandgaon, Chhattisgarh; 10 patients who satisfied inclusion criteria were selected for the study. The selected patients were divided randomly in two Groups. 5 out of the selected 10 patients underwent vestibuloplasty with polyethylene tube with sutures as fixation method (Group 1) and other 5 underwent vestibuloplasty procedure with impacted post as a fixation method (Group 2). In all patients collagen membrane was used as a graft material to cover the surgical defect.The study performed in one year period from January 2013 to January 2014.

Method of collection of Data

Preoperative OPG radiograph was taken to assess the bone height, configuration and to plan the surgery. Preoperative and postoperative photographs were taken for immediate assessment and long term follow up. Depth of the sulcus was recorded preoperatively, immediate postoperatively, and during follow up at intervals of 10 days, 1 month, and 3 months using vernier caliper. All the patients were explained about the procedure in their understandable language and a written informed consent was obtained.

Inclusion Criteria

1. Completely edentulous patients with reduced vestibular depth in mandibular labial region including previous denture wearers.
2. Both sexes were included in the study.
3. Patients aged between 40 and 75 years were selected.
4. Patients having OPG radiographs revealing atleast 15mm of the basal bone in mandible were selected.

Exclusion Criteria

1. Severely debilitated patients.
2. Patients with local pathology.
3. Patients with flabby and knife edge ridges.

Surgical Procedure

Under strict aseptic conditions and Local anesthesia, Clark's labial vestibuloplasty technique was carried out. Supra periosteal incision labial to the crest of the ridge at the junction of free and attached mucosa, ending just short of the mental foramina on either side was taken. A supra periosteal flap was then dissected with sharp scissors and care was taken to protect the mental nerves. More than 5 mm of mentalis muscle attachment was preserved above the inferior border of the mandible. Muscle fibers and loose connective tissue were meticulously separated from the periosteum. Due care was taken to keep the periosteum intact so as to provide a good bed for the graft. The flap was sufficiently undermined so that it could stay in its new position without tension. It was sutured to the periosteum at the base of the newly extended vestibule using 4-0 catgut interrupted sutures. In Group 2 patients , 3 holes were drilled using surgical handpiece and 702 bur at three points. Impacted post inserted, the flap sutured to the holes of the posts.

Collagen membrane of size 5 cm x 5 cm was taken out from the pack, washed with normal saline and cut into the required dimensions. It was then secured to the periphery of the recipient site with the help of 3-0 mersilk interrupted sutures. The depth of the sulcus was measured and recorded.

In Group 2 patients, Polyethylene tube was cut to the appropriate size and applied both extra orally and intra orally and fixed with 1-0 mersilk suture. Appropriate antibiotics and anti-inflammatory analgesics were prescribed.

Results

A total number of 10 patients with shallow vestibule and high mentalis muscle attachment in the mandibular labial

region were selected for this study. All the patients underwent Clark's vestibuloplasty procedure. Out of 10 patients 5 received Polyethylene Tube with sutures as the method of fixation for the apically positioned flap at the newly created sulcus depth and remaining 5 received Impacted Posts as the method of fixation.

Among the 10 patients, 8 were male and 2 were female patients, age ranged between 40 and 75 years. 2 of the 10 patients were old denture wearers. Basal bone height measured of the OPG radiograph ranged between 24mm and 38mm. The preoperative sulcus depths in the two comparison groups, polyethylene tube as fixation method, depth ranged between 2 mm and 4 mm with a mean of 2.29 mm (S.D.= 0.76), where as in the group which received impacted posts as the fixation method ranged between 1 mm and 4 mm with a mean of 2.71 mm (S.D.=1.11). Sulcus depth was measured preoperatively, immediate post operatively, 10th post operative day, at 1 month and 3 months for both the groups of patients. The mean increased sulcus depth at immediate post op period was 12.2mm (SD 1.10) for Group1 and 12.4mm (SD1.14) for Group 2. At 1 month follow up mean sulcus depth was 10.3mm (SD 0.68) for Group 1 and 10.4mm (SD 0.55) for Group 2. At three months post op Group 1 mean sulcus depth of 9.44mm (SD 0.55) and for Group 2, 9.5mm (SD 0.71) were recorded. Relapse percentage for Group 1 ranged between 16.6% and 28% with a mean of 22.684 (S.D. =5.046), and for Group 2 ranged between 16.6% and 28.5% with a mean of 22.959 (S.D. =7.797). For comparison between the two Groups, an independent student 't' was applied ,the p= 0.784 for immediate sulcus depth, p= 0.809 for 3 months, p=.949 for the relapse percentage. All the values obtained p > .005, which proved that though the relapse percentage was significantly less than that of acceptable 50%, there was no significant difference between the two methods of fixations considering the relapse percentage.

Discussion

After removal of natural teeth, remodeling of the alveolar process results in reduction in the height and width of the residual ridges. In a mixed longitudinal study of edentulous individuals covering 25 yrs of complete[20]denture wearing Antje Tallgren revealed a continuedreduction of the residual ridges throughout the observation period. The reduction of lower ridge was particularly marked, the mean reduction in the anterior ridge height being approximately four times as great as that of the upper ridge. The continued resorption, especially of the lower ridge, therefore, constitutes a serious prosthodontic problem. In our study, we found most of the patients showed shallow mandibular labial vestibule (1-4mm) and[21]high mentalis muscle attachment.[6]Starshak T, Sanders B 1980 prefer Clark's procedurewhich leaves a raw periosteal surface. Clark's technique is based on four principles of plastic surgery,

1. Raw surface on connective tissue contract, whereas the same surface undergo minimal contraction when covered with epithelium.
2. Raw surface overlying bone cannot contract.
3. Epithelial flaps must be undermined sufficiently to permit repositioning and fixation without tension.
4. Soft tissues undergoing plastic revision have a tendency to return to their former position, so over correction and firm fixation are necessary.

Hence in our study we chose to perform Clark's vestibuloplasty procedure for all the patients. All the patients included in this study were as per the indications of vestibuloplasty procedure as given by James Amphlett11in 1982.[11]

The main concern after vestibuloplasty procedure is the relapse of the gained surgical depth of the vestibule due to healing by secondary epithelialization. There are two

distinct processes in the healing of vestibuloplasty wounds, the first is active process of contraction and[33]second is remodeling. The relapse occurs as a result ofcoverage material for vestibuloplasty wound. The results of our study are comparable to the study conducted by3him.Another method of reducing relapse is adequate fixation of the flap at the newly created sulcus depth. Use of presurgically constructed over extended surgical stentswound contraction, loosening of new mucosa and muscle fixed with circummandibular wires has been described by[34]attachments.The relapse can be anywhere between 20-[7,9,56,57]many authors.[58]according to Stone and Madden90% of immediate postoperative depth after secondary6epithelialization. According to Starshak and Sanders arelapse of less than 50% is acceptable. They have also stated that over correction is necessary and should be attempted whenever possible. Various graft materials have been described by many authors to cover the raw surface and prevent wound contracture. Use of these grafts reduce[55]the contracture to 20-30%for e.g., split skin grafts,palatal and buccal mucosal grafts, xenogenous fascial graft, Terudermis, collagen membrane. Use of split thickness skin grafts to improve the denture bearing area5has been described by Moscowics 1916, Esser 1917, they[2]do reduce the relapse to about 25-30% but have manydisadvantages and complications which have been[2,7,11,25,47,48]described.Collagen membrane was used as agraft material in mandibular vestibuloplasty by Dr. K.[3]Ranganath for his thesis submitted to RGUHS, as iteliminates the need for secondary donor site, decreases operating time and comparative relapse is negligible and insignificant. In his study the duration of healing with collagen was about 4 weeks same as palatal grafts. Scar tissue was not evident; percentage of relapse was 22.2% which was comparable to 19.1% relapse with palatal grafts. Chair side time was significantly reduced, and second surgical site was avoided. Hence in our study we chose to use collagen membrane (Kollagen) as themechanical splinting and split skin grafting significantly reduced the wound contraction, but Alan Samit and Harry[25]Popowich have said that preoperative model surgery andfabrication of surgical stent were time consuming and only approximate. Adaptation of the stents to the newly exposed ridge was often only marginally satisfactory. Intraoperative manipulation of reline material was difficult and frustrating. Poor adaptation of the stent jeopardized graft survival, and displacement of the graft during insertion and removal of the stent frequently. The relatively large number of submandibular awl passes may increase the risk of significant edema and bleeding in the floor of the mouth, and may increase the risk of infection. A fixation method using polyethylene tubes with sutures has been described by Fouad Al Mahady Al Belasy. According to him over correction was unnecessary with14this type of fixation. Correct technique of its application51is described by J.R.Moore. Use of impacted posts forstabilization of apically positioned flap has been described[15]by Philippe Bousquet. These impacted posts have alsobeen used in orthodontics for anchorage purposes and for[40]fixations of flap after periodontal procedure. In thesetwo studies stents were not used for fixation of the flap. Various other techniques of such fixation have also been41described such as bone screws, acrylic stent fixation[42] [43]with AO screws, K-wires with varying success.

In our study, we have used and compared the efficacy of polyethylene tube with sutures and impacted posts for fixation of flap after vestibuloplasty and results were compared with regards to relapse percentages. The duration of fixation was 10 days. Surgical site healing was satisfactory by 10th postoperative day and complete

healing occurred within 4 weeks. There were no signs of scar tissue at the surgical site, and prosthetic rehabilitation was considered within 4-6 weeks to prevent loss of vestibular depth in early postoperative period as suggested[13]by Liposky R B.In our study mean preoperative depth was 2.29 mm (SD= 0.76) for polyethylene tube with sutures fixation group and 2.71 mm (SD =1.11) for impacted post fixation group. The mean immediate postoperative depth for polyethylene tube fixation group 12.2 mm (SD=1.10) and for impacted post fixation group it was 12.4 mm (SD=1.14). Mean of the depth of the sulcus at end of 3rd month for polyethylene tube fixation was 9.4 mm (SD=.55) and for impacted post group 9.5 mm (SD=7.1). A total gain of7.11 mm (SD=.21) for polyethylene tube fixations group and 6.79 mm (SD=.50) which was comparable with a mean gain of 5.7 mm (SD=2.2) as described by Fouad Al1[4]Mahady Al Belasy. As they did not use any graft tocover the denuded surgical site that could be probable reason for reduced gain of sulcus depth by them.In our study percentage of relapse for polyethylene tube ranged between 16-28% with a mean 22.8% (SD 5.046%) and for impacted post 16-25% with the mean of 22.954% (SD=7.80). Thus the overall relapse is significantly lesser6than acceptable 50%, and similar to 19-22% as described[3]by Dr. K. Ranganath. On comparing the two methods offixation statistically for relapse percentage p=0.949 (p>0.005), it is statistically not significant. In our studystents were not used for any of the patients which avoids[25,49]the disadvantages associated with the stents.Another concern with vestibuloplasty procedure is formation of sharp “V” that is created in the depth of the vestibule. This sharp “V” constitutes a problem for both the prosthodontist and the patient. The prosthodontist has difficulty in extending the denture flange into this “V” area and patients have difficulty in cleaning this area. None of our patient at the end of 3 months follow up had formation of this sharp “V” at the depth of the newly created vestibule as with the modification which have[13,14]been described.None of our patients had any of the complications which46,47are described after vestibuloplasty procedure anddenture tolerance was satisfactory by all our patients as[24]per Landsman HM.The overall gain of vestibular depth and the relapse rates were comparable for both impacted posts and polyethylene tubes with sutures as fixation method for the apically positioned flap after Clarks’ vestibuloplasty procedure. With the use of these fixation methods need to use stent was eliminated hence avoiding the disadvantages associated with the same. With the use of collagen membrane as graft material, the advantages were avoiding a second surgical site, and decreased operating time. Good healing without scarring was achieved. Hence, collagen can be recommended as a good alternative to the skin graft / palatal graft etc,. All the patients were comfortable and satisfied with their denture.This study did have the limitation of small sample and short length of follow up.To conclude, we recommend the routine use of Clarks’ vestibuloplasty procedure for patients with shallow mandibular labial sulcus and high mentalis muscle attachment with collagen membrane as the graft, and either impacted posts or polyethylene tubes with sutures as the fixation method. The findings of this study could be confirmed with a larger sample size and longer length of follow up, as the statistics of this study show a statiscally significant trend towards reduced relapse rates with the use of the two fixation methods compared.

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Tables and Figures

Table 1: Preoperative Labial Sulcus Depth (in mm)

Method	Range (Min- Max)	Mean	Standard Deviation
Polyethylene Tube Fixation	1-4	2.29	0.76
Impacted Post Fixation	1-3	2.71	1.11

t=1.086, d.f=18, p=0.292 (p>0.05)

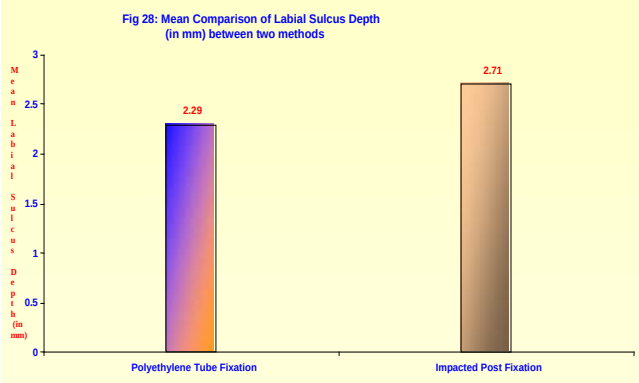
Table 2: Comparison of postoperative mean Sulcus depth at different time interval

Method	Immediate Postoperative Sulcus Depth in mm		Sulcus Depth after 10th Postoperative Day in mm		Sulcus Depth after 1 month in mm		Sulcus Depth after 3 month in mm	
	Mean	SD	Mean	**SD**	Mean	SD	Mean	SD
Polyethylene Tube Fixation	12.2	1.10	11.8	0.84	10.3	0.68	9.4	0.55
Impacted Post Fixation	12.4	1.14	11.4	0.55	10.4	0.55	9.5	0.71
't' value	0.283		0.894		0.258		0.250	
'p' value	0.784		0.397		0.803		0.809	
inference	Not Significant		Not Significant		Not Significant		Not Significant	

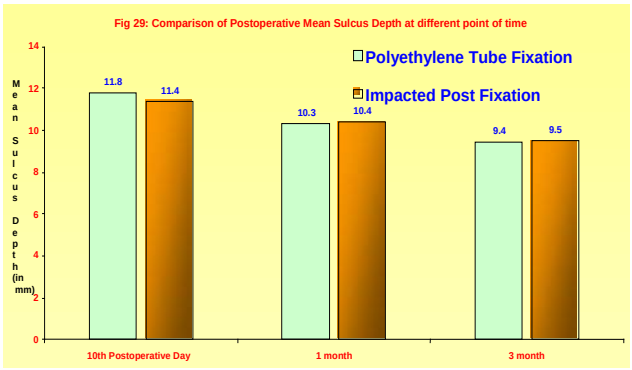
Table 3: Mean Comparison of change from immediate post operative to 3 months and Percentage of Relapse among two methods

Method	Mean Change of Sulcus depth from Immediate post operative and after 3 months in mm and SD	Percentage of Relapse and (SD)
Polyethylene Tube Fixation	2.8 (0.837)	22.68 (5.05)
Impacted Post Fixation	2.9 (1.245)	22.96 (7.80)
T value	0.149	0.066
p value	0.885	0.949
Inference	Not Significant	Not significant

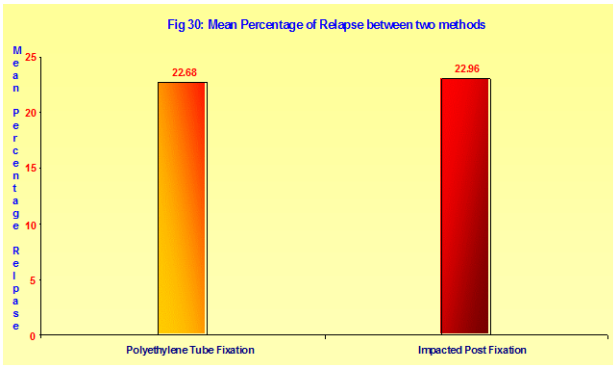
Graphs



Graph 1



Graph 2



Graph 1

Figures

Figure 1 : Impacted posts

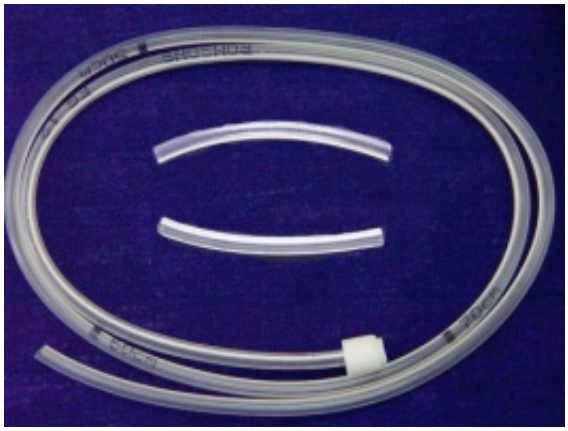


Figure 2 : Polyethylene Tube

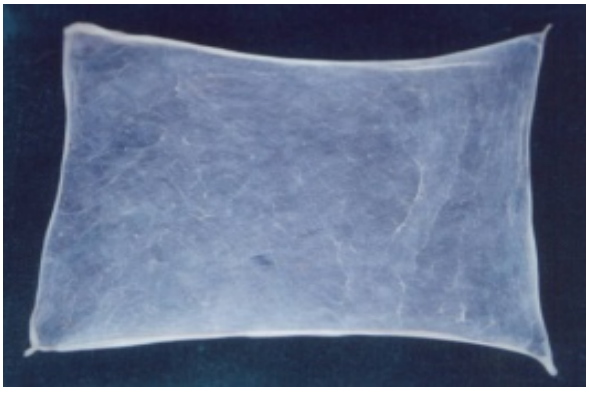


Figure 3 : Collagen Sheet

Figure 4 : Pre op measurements

Figure 5: Immediate post op with collagen sheet

Figure 6: Immediate post op with Impacted posts

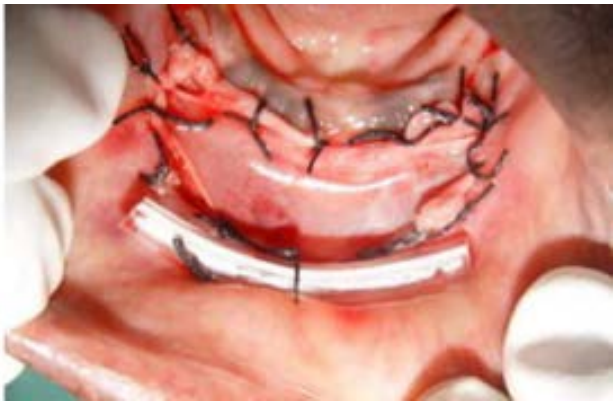


Figure 7 : Immediate post op with Polyethylene Tube intra oral

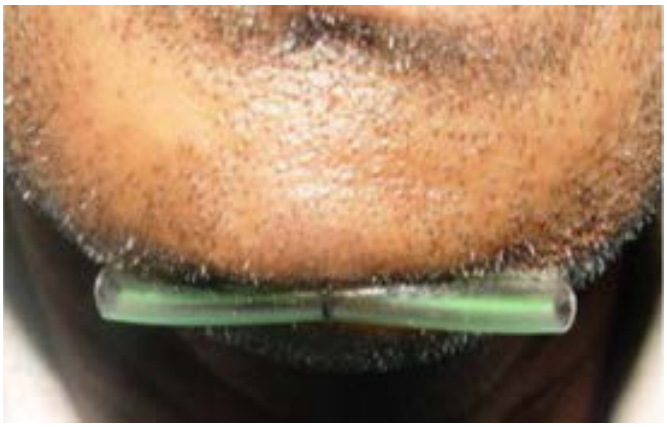


Figure 8 : Immediate post op with Polyethylene Tube extra oral

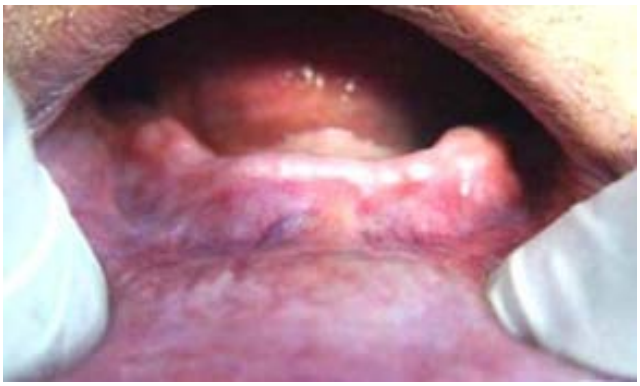


Figure 9: 3 months post op