

Clinical Paper
Pre-Prosthetic Surgery

Vestibuloplasty: allograft versus mucosal graft

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Abstract. The aim of the present study was to compare the application of alloderm and mucosal graft for vestibuloplasty. This randomized controlled trial with split mouth design was carried out on 20 edentulous patients. Patients underwent vestibuloplasty surgery with the Clark technique. Half of the prepared bed in each patient was covered with alloderm and the other half with mucosal graft. Vestibule depth (width of fixed tissue) and relapse in the two sides immediately after surgery, and 1, 3 and 6 months after surgery were measured and compared. Statistical analysis was carried out using the Kolmogorov–Smirnov, Student’s paired *t* and Friedman tests. The width of the fixed tissue in the alloderm graft at 1, 3 and 6 month intervals was significantly lower than that in the autograft ($P < 0.05$). The difference in relapse between the two grafts was not statistically significant at any time. The results of the study suggest that alloderm is as effective as mucosal grafts in vestibuloplasty.

Keywords: Vestibuloplasty; Allograft; Mucosal graft; Vestibule depth (width of fixed tissue).

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When alveolar ridge resorption occurs in the edentulous mandible, the surface of the attached mucosa on the ridge decreases. In this situation, the connection of the mucosa and muscles near the seat of the complete denture plays an important role in prosthesis retention and stability. A way of increasing the stability of the prosthesis in this circumstance is to deepen the vestibule by lowering the connection of the mucosa and muscle, or ‘vestibuloplasty’. Various approaches to vestibuloplasty have been developed since 1935. The three main techniques to deepen the vestibule are: lip-switch technique, submucosal vestibuloplasty, and soft tissue graft¹.

During the last two decades, a routine approach for vestibuloplasty has been free gingival graft¹. This approach requires a graft from a donor site, usually the palate. This type of graft increases morbidity and

there are surgery related risks, such as damage to the nerve, periosteal necrosis, and osteomyelitis in the donor site⁸. When the graft covers a large surface, sufficient palatal tissue may not be available, and vast bleeding may occur¹. When using the buccal area as the donor site, trauma to the Stenson duct, scar development, and sometimes limitation in mouth opening may occur¹.

Skin grafts have also been used as good alternatives since they encounter no problems with shrinkage and scars, which are unavoidable in the secondary epithelialization process⁷. Studies show a high level of satisfaction in patients with vestibuloplasty with partial thickness skin graft⁵. When used in the mouth, skin has associated problems that lead to patient dissatisfaction: it is a different colour and texture from normal mouth epithelium; in

the first years after grafting, there is a bad taste or odour, probably resulting from the presence of hair and sebaceous glands in the graft and insufficient oral hygiene; and the development of scars and discomfort in the donor site⁷. Hillerup et al. found *Candida albicans* hyphae in the smear tests of some patients, and residual ridge resorption were more severe than in those with a healthy skin graft⁴.

Alloderm is a donated human skin that is aseptically processed and has had its cells removed although the biological parts and skin matrix frame have been maintained¹². It is a dried and frozen skin matrix without cells, which has a homogeneous basement membrane structure, and extra-cellular matrix. The main components of alloderm are collagen and elastic fibre. It has been approved by the US FDA as a human tissue which can be used as

graft¹². It has been used since 1992 in burn injury surgery and since 1994 in corrective plastic and periodontal surgery¹⁰. The successful use of alloderm in periodontal surgery increased its implementation as a tissue implant in constructive and plastic surgery^{6,11}. Recently, alloderm has been used to cover root surfaces in root resorption³. It has also been used to increase attached gingiva around teeth and implants².

Alloderm has been introduced as an alternative to autogenous palatal grafts¹⁵. In this type of grafts the surface epidermal layer above the basement membrane, all the skin cell structures and other factors causing graft rejection are removed before freeze drying¹². Requiring no surgery at the donor site, this graft offers advantages over mucosal grafts such as decreased bleeding and post-surgery complications and unlimited availability. Its colour is also better than that of mucosal graft.

The aim of the present study was to compare application of alloderm and free gingival graft for vestibuloplasty.

Materials and methods

This randomized controlled trial with split mouth design was carried out in 20 edentulous patients. The research was approved by the Research Ethics Committee of Tehran University of Medical Sciences. Subjects were selected from the edentulous patients referred to the authors' department between October 2007 and August 2008 for vestibuloplasty surgery. Clinical examination and panoramic radiography was performed for the patients and those with at least 15 mm alveolar ridge height in the mandible and insufficient vestibule depth were selected (Fig. 1). Another inclusion criterion was the absence of any systemic condition. 20 patients, 9 male and 11 female, with a mean age of 61 years (range 50–81 years) met all the criteria for this research. All patients signed the informed consent form for the study.

Patients underwent vestibuloplasty surgery using the Clark technique⁷. To eliminate any confounding factors including age, sex, immunological response, and muscle activity, half of the prepared bed in each patient was covered with alloderm and the other half with buccal mucosal graft (Fig. 2). A buccal mucosal graft the size of the recipient site was harvested from the submucosal tissue under the Stenson duct. The grafts were placed on the periost and sutured to the peripheral soft tissue and fixed in the centre by suturing to the periost by absorbable



Figure 1. Patient with inadequate vestibular depth.



Figure 2. Half of the prepared bed was covered with alloderm and the other half with mucosal graft (immediately after surgery).

sutures. No external fixation technique, such as soaked gauze or relined denture, was used. The allocation of these two grafts to the two sites in each patient was carried out randomly.

The alloderm rehydration process was carried out in a two-stage bath with

warmed normal saline under gentle mixing for 10–40 min.

Immediately after surgery an examiner, blinded to the treatment, measured and recorded the width of the fixed tissue as the indicator of vestibule depth, at three points: near the midline; at the midpoint of



Figure 3. 1 month after surgery.



Figure 4. 6 months after surgery.

Table 1. Mean vestibule depth (SD) at various intervals in the two methods of vestibuloplasty.

	Alloderm	Autograft	Mean difference	Standard deviation	P value
Immediately after surgery	9.78 (1.48)	10.75 (1.98)	-0.3	0.95	0.34
One month after surgery	7.80 (2.67)	8.48 (2.53)	-0.68	0.84	0.03
Three months after surgery	5.55 (2.05)	6.51 (1.1)	-0.96	1.28	0.04
Six months after surgery	3.78 (2.58)	5.34 (1.99)	-1.56	1.53	0.01

Table 2. Mean relapse (SD) at various intervals in the two methods of vestibuloplasty.

	Alloderm	Autograft	Mean difference	Standard deviation	P value
One month after surgery	1.98 (2.05)	1.6 (1.68)	0.38	0.68	0.1
Three months after surgery	4.23 (2.09)	3.56 (1.99)	0.66	1.32	0.15
Six months after surgery	6.0 (1.95)	4.79 (2.68)	1.21	1.81	0.06

the graft; and at the distal end of the graft. The average width of the fixed tissue at these points was considered as the final 'baseline vestibule depth'. The measurement was repeated 1 (Fig. 3), 3 and 6 months after surgery (Fig. 4), and the width of the fixed tissue (vestibule depth) was calculated with the same approach at these intervals. As another outcome variable, 'relapse' was defined as the difference between the width of the fixed tissue at these intervals and 'baseline vestibule depth'.

Statistical analysis was carried out with the Kolmogorov-Smirnov, Student's paired *t*, and Friedman tests.

Results

The Kolmogorov-Smirnov test showed that the distribution of width of the fixed tissue and relapse in both types of the grafts was normal ($P > 0.05$). The width of the fixed tissue in the alloderm graft at 1, 3 and 6 month intervals was significantly lower than that in the autograft ($P < 0.05$) (Table 1), but the difference in relapse between the two grafts was not

statistically significant at the time intervals measured (Table 2).

In both types of grafts, the width of the fixed tissue at the 1 month interval was significantly more than the width of the fixed tissue at the two other intervals ($P = 0.001$), and the average relapse at the 6 month interval was more than the two other intervals ($P = 0.001$).

Graft rejection was observed in none of the cases. After 6 months, the tissues resulting from both grafts were clinically non-keratinized and fixed to the underlying bony bed.

Discussion

The present study investigated the capability of alloderm graft for implementation in vestibuloplasty surgery in comparison with autograft. The results showed that here were no differences between the two types of graft in terms of relapse at various intervals after vestibuloplasty surgery.

The study benefited from a split-mouth design, eliminating the influence of many confounding factors. One surgeon

performed all the surgery, and the examiner was blind to the type of the graft used. The technique of vestibuloplasty used in the present study was the Clark technique, which has the advantages of less shrinkage and relapse compared with other techniques such as the Kazanjian, Godwin, and Cullet techniques⁷.

Wong et al. investigated angiogenesis and lymphangiogenesis following alloderm graft¹³. Histologic examination revealed that the response to alloderm is similar to the normal wound healing process¹³. Xu et al. investigating immunologic response to alloderm in an animal model reported that a slight inflammatory response with the presence of macrophage and lymphocytes was observed within 1 month after grafting. This response disappeared in the third month¹⁴. In contrast, clear inflammation was evident following cellular grafts, shown by infiltration of immune cells, the presence of G-binding immunoglobulin, precipitation of C5b and TNF-alpha, and activation of macrophages¹⁴.

Bhola et al. introduced alloderm as an alternative to soft tissue autogen graft in pre-prosthetic surgery¹. They performed vestibuloplasty using a cellular dermal autograft before complete denture treatment for a patient with edentulous maxilla and multiple frenumes. No adverse events occurred during the healing period, and clinical examination after 6 months indicated increased vestibule depth, apical movement of mucogingival line, and absence of multiple frenumes¹. Their result is consistent with the present findings.

Sezar et al. compared the efficiency of fascia lata and solvent-preserved dura matter with palatal mucosal graft in vestibuloplasty⁹. 6 months after the surgery, a clear decrease was observed in the vestibule depth of the fascia lata group, but no significant difference was found between the dura matter and palatal mucosal grafts. They concluded that solvent-preserved allograft can be used as a biologic coverage in mucosal defects where palatal graft can be used.

The results of the present study suggest that alloderm is as effective as mucosal grafts in vestibuloplasty. Using alloderm is not beneficial economically but with this technique the extra surgery required to take the mucosal graft and the consequent trauma can be avoided and the time of surgery will decrease. The use of alloderm graft as an alternative to mucosal grafts seems to be recommendable. Other topics for research in this field could be histologic assessment of alloderm graft and comparison with autogenous mucosal graft.

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Competing interests

None declared.

Ethical approval

Not required.

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