



ELSEVIER

Available online at www.sciencedirect.com

SciVerse ScienceDirect

British Journal of Oral and Maxillofacial Surgery xxx (2011) xxx–xxx

BRITISH
Journal of
Oral and
Maxillofacial
Surgerywww.bjoms.com

Use of amnion as a graft material in vestibuloplasty: a clinical study

Chaitanya R. Kothari*, Gayathri Goudar, Neelakamal Hallur, Basavraj Sikkerimath, Santosh Gudi, Meenakshi C. Kothari

M.D.S Oral and Maxillofacial Surgery, Al-Badar Dental College and Hospital, Gulbarga, Karnataka, India

Accepted 30 September 2011

Abstract

The need to cover the exposed periostium has meant that a number of materials including mucosal and skin grafts are regarded as suitable for grafting in oral and maxillofacial surgery. To circumvent the disadvantages of other materials such as skin, biological membranes have been suggested as options, including fetal membrane. The objective of the present study was to evaluate the clinical efficacy of amnion as a graft material for vestibuloplasty, to increase the depth of the sulcus for complete rehabilitation with dentures in 10 patients with a follow up period of 3 months. Ten patients with deficient depth of the mandibular vestibular sulcus who were referred from the Department of Prosthodontics were listed for mandibular labial vestibuloplasty using Clark's technique followed by grafting with amnion over the denuded periostium. The vestibular depth was evaluated at the end of the 1st week, 2nd week, 4th week, and 3rd month postoperatively, and compared with the preoperative vestibular depth. We had no cases of graft necrosis either complete or partial. However, the reduction in the depth of the labial vestibule ranged from 17% to 50% after 3 months' follow up. A mean (SD) labial vestibular depth of 13.3 (1.8) mm was achieved immediately postoperatively, and 10.0 (3.1) mm at 3 months' follow up. We conclude that grafts of amniotic membrane are viable and reliable for covering of the raw surface, prevent secondary contraction after vestibuloplasty, and maintain the postoperative vestibular depth.

© 2011 The British Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Keywords: Vestibuloplasty; Amnion graft; Vestibular depth

Introduction

Procedures to improve the base for an inadequately supported, complete mandibular denture have been attempted since dentists began replacing natural dentition with artificial removable prostheses. Labial vestibular extension has long helped to provide a better foundation for the prosthesis by reducing high muscle attachments and providing a large area of non-displaceable attached tissue.¹

Since the Consensus Conference in Berlin in 1983,² there has been no difference of opinion about the need to cover the exposed periostium, because a nearly complete relapse

could happen during secondary healing with contraction and epithelialisation of the vestibular periostium. There was no consensus, however, about the preferred type of graft.

Numerous grafts are available in oral and maxillofacial surgery, from autogenous mucosal to allogeneic collagen membrane. They have proved their efficacy by replacing lost structure and providing surface coverage, but their limitations,³ which include availability, morbidity at the donor site, difficulty in harvesting, intensity of pain, chances of rejection and infection of the grafted area, cost, technique, processing, and availability of allogeneic membrane means that there is an urgent need to search for an alternative graft material.

Human amniotic membrane is a biological graft that has unique properties, which include being antiadhesive and bacteriostatic,⁴ it protects the wound, causes little pain, and achieves good epithelialisation. Another important

* Corresponding author at: M.D.S Oral and Maxillofacial Surgery, House no. 1-46/11A, Court Road, Station Bazaar, Gulbarga, Karnataka 585102, India. Tel.: +91 08472221410; mobile: +91 9972081338.

E-mail address: chaitanya.kothari@gmail.com (C.R. Kothari).



Fig. 1. Harvested amniotic membrane.

characteristic is the lack of immunogenicity.^{5,6} Its excellent biological and biophysical properties, its easy availability, and the comparatively low costs for preparation, storage, and use makes it successful when compared with other grafts.⁶ Recent studies have shown that it is an abundant source of stem cells with the ability to differentiate into chondroblasts, osteoblasts, adipocytes, myocytes, and neuronal cells.^{7,8} According to Alviano et al.⁹ these cells have the ability to differentiate into endothelial cells and also properties that are necessary to regulate angiogenic processes.

To evaluate the efficacy of grafts of human amniotic membrane we conducted a clinical study in which a graft of amnion preserved in glycerol was used to cover the denuded surface of the periostium on the mandibular labial surface after vestibuloplasty.

Patients and methods

Ten medically fit patients with insufficient mandibular vestibular depth were referred from the Department of Prosthodontics for vestibular extension procedures. Patients with atrophic ridges, and immunocompromised and uncooperative patients, were excluded from the study.

The patients gave informed written consent. The depth of bone and quality and quantity of mucosa were assessed radiographically and clinically.

Before the patient was listed for operation, a preoperative impression was taken and a splint fabricated with clear acrylic, finished, and polished.

Preparation of the amniotic graft

Fresh amniotic membrane was obtained from healthy seronegative mothers who had had caesarian sections, with their written consent. The work was approved by the ethics committees of PMNM Dental College and Hospital, Bagalkot. Amniotic membrane (Fig. 1) was kept at 37 °C overnight and was then refrigerated at 4 °C in glycerol¹⁰ until



Fig. 2. Preoperative vestibular depth.

used. Once harvested and stored it could be used for a number of patients (Fig. 2).

Vestibuloplasty and stabilisation of the graft

After preparation the preoperative vestibular depth was measured using calipers and a Clark's vestibuloplasty was done in the anterior mandibular labial vestibule (Fig. 3). A horizontal incision was made at the mucogingival junction on the residual ridge that extends from the right to the left molar area. A large mucosal flap was undermined well out into the lip, and the vestibule deepened with supraperiosteal dissection. The flap was then sutured to the desired vestibular depth.

To cover the exposed periostium, we used clean sections of amniotic membrane 6 cm × 10 cm (Fig. 4) that had been cut and kept in saline 400 ml containing penicillin 1,000,000 IU at 48 °C for 24 h preoperatively. To secure the graft, the surgical splint was placed after it had been lined with a soft liner to prevent the formation of dead space, and secured with bone screws 1.5 mm × 6 mm. The splint was removed after the 7th day postoperatively and the grafted site thoroughly cleaned. Patients were followed up and their vestibular depth measured at intervals of 1 week, 2 weeks, 1 month, and 3 months postoperatively (Fig. 5). Care was taken that all the vestibuloplasty procedures were done, and their measurements made, by same operator.



Fig. 3. Clark's vestibuloplasty incision and reflection of the supraperiosteal flap.



Fig. 4. Suturing of amniotic graft to denuded periosteum.

Results

There were 5 men and 5 women, age range 35–70 years. They had all been edentulous for less than 2 years. Preoperative clinical findings, radiological investigations, and vestibular depth were assessed. None of the patients had postoperative oedema, swelling, or pain that could not be controlled effectively with analgesics. There were no complications such as rejection or infection. However, the reduction in the depth of the labial vestibule ranged from 17% to 50% after 3 months' follow up. The mean (SD) preoperative vestibular depth 3.3 (0.7) mm, and during operation it was 13.3 (1.8) mm. Mean (SD) postoperative depths were 11.9 (0.7) mm after 1 week, 11.1 (0.7) mm after 2 weeks, 10.5 (0.8) mm after 4 weeks, and 10.0 (3.1) mm after 3 months.

The patients were fitted with their prostheses a month postoperatively. One patient had a relapse of the vestibular depth to almost its preoperative value (mainly because of inability to maintain oral hygiene and uncooperative behaviour).

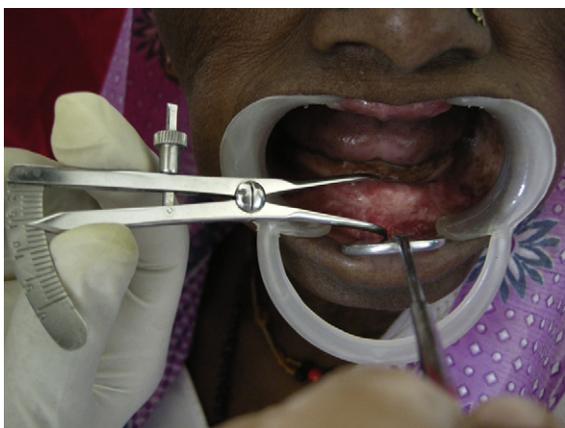


Fig. 5. Postoperative healing and vestibular depth.

Discussion

Severe resorption of the mandibular ridge is a common problem in edentulous patients and severely compromises the success of prosthodontic treatment. The patient may have an atrophied ridge on which rests a small area of attached mucosa. The bony foundation may be even larger, but the presence of muscle and membranous attachments limits the useable areas of support.¹¹

Their use depends on sufficient bone being available, and the suitability of the soft tissue.³ It has been suggested that expansion of the denture-bearing area by a vestibuloplasty would reduce denture load/square unit of supporting bone, and so reduce the bony resorption caused by transfer of occlusal forces.¹ The aim of the technique is to create adequate vestibular depth and limit the traction of fibre and muscular attachments of the different transplants.³

Different transplants are available to cover the denuded raw surface and prevent contraction after secondary epithelialisation. Postoperative wound reconstruction has always been a challenge, and requires good wound care followed by coverage with various biological or bioengineered skin substitutes. An autologous skin graft has limited availability and is associated with additional morbidity and scarring. Bioengineered skin substitutes have the drawback of limited viability, limited quantity, and high cost. Locoregional flaps and free flaps also have their own morbidity. We successfully managed the postoperative wound using the amniotic membrane.

In recent years vestibuloplasty using free gingival¹² or split thickness^{13,14} skin grafts has become the preferred procedure because of its effective increase in vestibular depth and quantity of stable tissue. Various autogenous soft tissue grafts have been used for vestibular extension, particularly mucosa from the palatine area¹¹ and skin as full-thickness, split, or meshed transplants. The split-thickness skin graft is often used, but the functional and aesthetic results may be insufficient.² Better results are possible with a mucosal graft, but often not enough donor tissue is available.¹⁵ All grafts have the disadvantage of increased morbidity and postoperative pain, and risk of complications at the donor site. New approaches to the treatment of soft tissues are needed urgently to improve patients' comfort.

To circumvent these disadvantages other biological membranes have been suggested as options, including fetal membranes. The amniotic membrane is formed from the ectoderm of the fetus. It has a stromal matrix, a thick layer of collagen, and an overlying basement membrane with a single layer of epithelium. It closely resembles the epidermis of the skin and has been used as a physiological wound dressing with great success.^{6,16} The amnion has the following advantages⁵: it is antiadhesive; it has bacteriostatic properties^{17,21}; it protects the wound¹⁸; it reduces pain¹⁹; it promotes secondary epithelialisation²⁰; it lacks immunogenicity¹⁸; it vascularises healthy granulation tissue and stimulates neovascularisation in neighbouring

tissues^{18,19}; it is inexpensive, readily available, and can be used fresh or lyophilised; and it can be stored at room temperature after sterilisation by gamma irradiation.¹⁶

Amniotic membranes, as described by Atiyeh et al.,²⁰ preserve a healthy excised wound bed; maintain a low bacterial count in contaminated wounds; decrease losses of protein, electrolytes, fluids, and energy; reduce the risk of infections; avoid bulky dressings; minimise pain; and accelerate epithelial regeneration, so shortening hospital stay.

To our knowledge the use of amnion in vestibuloplasty has been reported before only once, by Guler et al.,⁶ who concentrated on blood flow to the graft. They concluded that grafts of amnion might be better than other grafts in mandibular vestibuloplasty because of early healing, and stated that the angiogenic function of the amnion began within the first 10–15 days, and the blood flow returned to normal by 30 days postoperatively.⁶ Samandari et al.⁵ postulated that amniotic membrane might be a favourable graft material for vestibuloplasty, in that it promoted healing and prevented relapse.

Human amnion has been known to be an effective dressing since John Staige Davis used it in 1910 (quoted by⁶). Since then extensive studies all over the world have proved it to be an excellent biological dressing with almost all the qualities of an ideal dressing. Lawson in 1985 (quoted by¹¹) placed amnion over the deep aspect of the pectoralis major muscle for reconstruction of the oral cavity.⁵ Lai et al. in 1995 used a single layer of fresh amnion for surgical treatment of oral submucous fibrosis.²² Guler et al. in 1997 used grafts of amnion in mandibular vestibuloplasty.⁶ Rajendra Prasad²³ in 2008 used amnion as a dressing for various intraoral and extraoral sites. Rai et al.²⁴ used amniotic membrane as a biological dressing in cervical necrotising fasciitis, and described a new approach to prevent the need for extensive flaps or grafts to close the defect after debridement.²⁴ Lo et al.²⁵ illustrated the potential efficacy of grafting with amniotic membrane in promoting healing in patients with epidermolysis bullosa and chronic, non-healing wounds.

Amniotic grafts^{4,10} have opened new perspectives in medical care and will have a favourable influence in plastic and preprosthetic surgery. Several attempts have already been made to incorporate amniotic grafts into plastic and reconstructive procedures¹⁶ to avoid defects at the donor site, shorten operating time, and achieve better aesthetic and functional results.

The reduction in the depth of the buccal vestibule ranged from 14% to 30% after 3 months follow-up, and the graft area could not be differentiated from non-grafted tissue after 3 months compared with the 17–40% after 6 months follow-up in the study of Samandari et al.⁵

Our results show that the increases that we achieved in the postoperative vestibular depth indicated that amnion is an appropriate graft material for vestibuloplasty. This could lead to better results, shorter treatment time, and less morbidity at the donor site. The study also illustrates the versatility of angiogenic biodegradable amniotic membrane as a graft

material for vestibuloplasty, which promotes healing and prevents relapse.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Landesman HM, Davis WH, Martinof J, Kaminishi R. Resorption of the edentulous mandible after a vestibuloplasty with skin grafting. *J Prosthet Dent* 1983;**49**:619–22.
- Froschl T, Kerscher A. The optimal vestibuloplasty in preprosthetic surgery of the mandible. *J Craniomaxillofac Surg* 1997;**25**:85–90.
- Raguse JD, Gath HJ. A metabolically active dermal replacement (Dermagraft) for vestibuloplasty. *J Oral Rehabil* 2005;**32**:337–40.
- Stern W. The grafting of preserved amniotic membrane to burned and ulcerated skin. *JAMA* 1913;**13**:973–4.
- Samandari MH, Yaghmaei M, Ejlali M, Moshref M, Saffar AS. Use of amnion as a graft material in vestibuloplasty: a preliminary report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004;**97**:574–8.
- Guler R, Ercan MT, Ulutuncel N, Devrim H, Uran N. Measurement of blood flow by the ¹³³Xe clearance technique to grafts of amnion used in vestibuloplasty. *Br J Oral Maxillofac Surg* 1997;**35**:280–3.
- Kjaergaard N, Hein M, Hyttel L, Helmig RB, Schonheyder HC, Uldbjerg N, et al. Antibacterial properties of human amnion and chorion in vitro. *Eur J Obstet Gynecol Reprod Biol* 2001;**94**:224–9.
- In 't Anker PS, Scherjon SA, Kleijburg-Van Der Keur C, de Groot-Swings GMJS, Claas FHJ, Fibbe WE, et al. Isolation of mesenchymal stem cells of fetal or maternal origin from human placenta. *Stem Cells* 2004;**22**:1338–45.
- Alviano F, Fossati V, Marchionni C, Arpinati M, Bonsi L, Franchina M, et al. Term amniotic membrane is a high throughput source for multipotent mesenchymal stem cells with the ability to differentiate into endothelial cells in vitro. *BMC Dev Biol* 2007;**7**:11.
- Maral T, Borman H, Arslan H, Demirhan B, Akinbingol G, Haberal M. Effectiveness of human amnion preserved long-term in glycerol as a temporary biological dressing. *Burns* 1999;**25**:625–35.
- Sakuragawa N, Kakinuma K, Kikuchi A, Okano H, Uchida S, Kamo I, et al. Human amnion mesenchyme cells express phenotypes of neuroglial progenitor cells. *J Neurosci Res* 2004;**78**:208–14.
- Robson MC, Krizek TJ. The effect of human amniotic membranes on the bacteria population of infected rat burns. *Ann Surg* 1973;**177**:144–9.
- Amphlett J, Colwell WC. Edentulous vestibuloplasty using the palatal graft technique. *J Prosthet Dent* 1982;**48**:8–14.
- Hall HD. Vestibuloplasty, mucosal grafts (palatal and buccal). *J Oral Surg* 1971;**29**:786–91.
- Steinhauser EW. Vestibuloplasty- skin grafts. *J Oral Surg* 1971;**29**:777–85.
- Hillerup S. Preprosthetic mandibular vestibuloplasty with split skin grafts. A 2-year follow up study. *Int J Oral Maxillofac Surg* 1987;**16**:270–8.
- Raghoobar GM, Tomson AM, Scholma J, Blaauw EH, Witjes MJ, Vissink A. Use of cultured mucosal grafts to cover defects caused by vestibuloplasty. An in vivo study. *J Oral Maxillofac Surg* 1995;**53**:872–8.
- Ravishanker R, Bath AS, Roy R. Amnion Bank—the use of long term glycerol preserved amniotic membranes in the management of superficial and superficial partial thickness burns. *Burns* 2003;**29**:369–74.
- Baradaran-Rafii A, Aghayan HR, Arjmand B, Javadi MA. Amniotic membrane transplantation. *Iran J Ophthalmic Res* 2007;**2**:58–75.

20. Atiyeh BS, Hayek SN, Gunn SW. New technologies for burn wound closure and healing—review of the literature. *Burns* 2005;**31**: 944–56.
21. Stock SJ, Kelly RW, Riley SC, Calder AA. Natural antimicrobial production by the amnion. *Am J Obstet Gynecol* 2007;**196**:255e1–6e.
22. Lai DR, Chen HR, Lin LM, Huang YL, Tsai CC. Clinical evaluation of different treatment methods for oral submucous fibrosis. A 10-year experience with 150 cases. *J Oral Pathol Med* 1995;**24**:402–6.
23. Rajendra Prasad B, Sharma SM, Radha Prabhu K, Shetty VB. An innovative dressing for ulcers: a prospective study. *J Maxillofac Oral Surg* 2008;**7**:264–9.
24. Rai M, Ramaraj PN, Sharma A. Use of amniotic membrane as dressing in cervical necrotizing fasciitis. *J Oral Maxillofac Surg* 2011;**69**:1125–8.
25. Lo V, Lara-Corrales I, Stuparich A, Pope E. Amniotic membrane grafting in patients with epidermolysis bullosa with chronic wounds. *J Am Acad Dermatol* 2010;**62**:1038–44.