

CLINICAL EVALUATION OF REVERSED DERMIS GRAFT FOR RECONSTRUCTION OF ORAL MUCOSA

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ABSTRACT

A new technique for reconstruction of oral mucosa, named reversed dermis graft (RDG), was introduced. In the RDG, dermis freed from the epidermis was transplanted upside down. The graft was then covered by the surrounding mucosal epithelium to form the mucosal tissue, while the implanted tissue inhibited the wound contracture somewhat. The various mucosal defects in 20 patients were repaired with the RDG. Clinical and histological evaluation were conducted to analyze the value of this method.

- 1) In 20 patients, all parts of the oral cavity were reconstructed with RDG except for the palatal mucosa. The maximum graft size was 9×5 cm and the minimum graft size was 2.5×1.5 cm.
- 2) All grafts were reepithelialized with the surrounding mucosal epithelium within about 5 weeks. Hair growth, keratinization, and formation of dermal cyst were not seen in the reconstructed area.
- 3) The grafts contracted in all cases to about 55% of their original size.

I. INTRODUCTION

Skin graft technique has been used as a method for the reconstruction of defects of the oral mucosa caused by such surgical operations as resection of oral cancer and other oral mucosal diseases¹⁾²⁾. Mucosal grafting was introduced later and its superiority has been proved by many researchers,³⁾ but as the availability of the grafting mucosa is limited in the mucosal graft,⁴⁾⁵⁾ the skin graft is still the main method of reconstruction of the intraoral tissue defect. However, the grafted skin is in many cases keratinized and hair regrows in the oral cavity, as reported by Steinhauser *et al.*,³⁾⁶⁾⁷⁾ causing the patient unpleasant and unnatural feelings for a long time. Overcoming such problems has long been the subject of research in the area of intraoral reconstruction.

In 1981, we discovered a method⁸⁾ to solve such problem: i.e., the dermis, which is abundantly available in the donor site, is transplanted upside down to the part of the mucosal defect, and the surrounding mucosal epithelium is lead to the surface of the dermis (Fig. 1). This method is called reversed dermis graft (RDG). We applied the method in the animal experiments proving that a large area of the mucosal defect may be reconstructed with mucosal tissue⁹⁾.

Based on the above fundamental study, we have performed the RDG in 20 patients with various oral mucosal defects since 1981 at the Department of Oral Surgery, Nagoya University Hospital. In the present paper, we reported the operation procedure and the clinical results of RDG.

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Received for Publication August 30, 1985

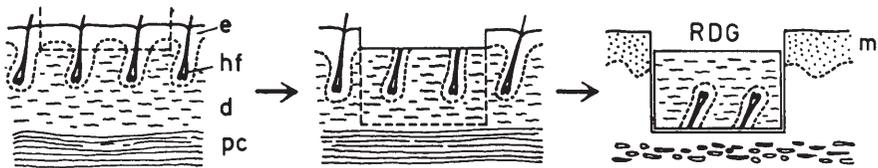


Fig. 1 Operation procedure of reversed dermis graft
 e : epidermis of skin, hf : hair follicle, d : dermis, m : mucosal epithelium

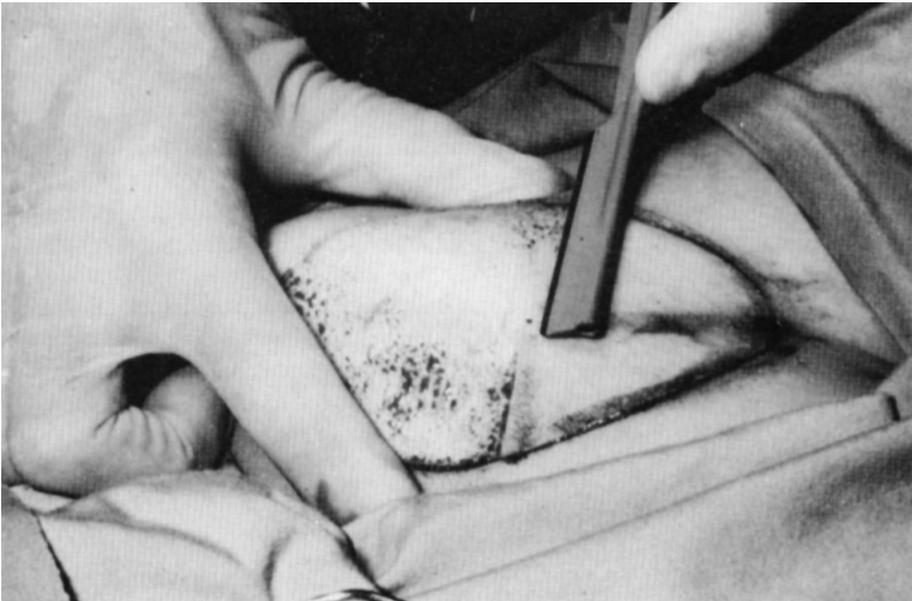


Fig. 2 The dermis is obtained from the inguinal region.
 The epidermis is removed by mean of a freehand dermatome.

II. OPERATION PROCEDURE

The dermis to be grafted is taken from the inguinal region of the patient. First, the area necessary for grafting is determined. Then, the superficial layer of the dermis is resected around the graft, and de-epithelialization is performed by a freehand dermatome (Fig. 2) at a depth of 5-10/1000 inch. The epidermis should be removed completely, and thus the dermis is obtained. The fatty tissue underneath the dermis is removed by forceps, therefore the obtained dermis contracts to half its original size due to its elasticity.

In order to distinguish the surface and the inner side of the grafted piece, one side of the dermis is marked with dye. The recipient bed should be completely hemostatic; as the shape of the recipient bed of the intraoral skin graft is usually concave, hematoma forms easily if the hemostat is not complete, and the operation may fail as a result.

The fixation of the graft is performed by the tie-over dressing with tetracycline (TC)-containing gauze, or a splint may be used. The surrounding oral epithelium must be smoothly connected to the graft allowing the overgrowth of the superficial epithelium. For this purpose, we used a biological tissue adhesive. The duration of the graft fixation is 7 to 10 days during which time the patient is, tube fed.

III. ANALYSIS OF CASES

We performed RDG in 20 patients at our department (Table 1). The age of the patients varied from 5 to 74 years old, with 9 males and 11 females. Their primary diseases were 10 cases with narrowing of the vestibular sulcus after the surgical operation of bilateral cleft lip and palate, 5 cases with malignant tumor (4 cases of tongue cancer and 1 case of mouth floor cancer; all cases were squamous cell cancer), 4 cases with benign tumor (1 case of lymphoangioma, 2 cases of papilloma, and 1 case of hemangioma), and 1 case with narrowing of the vestibular sulcus after surgical operation of mandibular cancer.

The recipient sites were the maxillary vestibular sulcus in 10 cases, tongue in 4 cases, cheek in 2 cases, upper lip in 1 case, lower lip in 1 case, mouth floor in 1 case and mandibular vestibular sulcus in 1 case. The size of the grafted piece was from 9 × 5 cm to 2.5 × 1.5 cm, and all grafts were obtained from the inguinal region. The graft completely survived in 17 cases and had partial necrosis in 3 cases (Table 2). The partial necrosis was caused by early loss of fixation. The super-

Table 1. Cases treated with RDG.
Twenty cases of RDG were performed for reconstruction of various mucosal defects.

Case	Primary disease	Age (years) Sex	Recipient site
1 ~ 10	bilateral cleft lip & palate	5 ~ 18 ♂ : 5 ♀ : 5	maxillary vestibule
11 ~ 16	malignant tumor	22 ~ 62 ♂ : 4 ♀ : 1	tongue : 2 mandible } mouth floor : 3
17 ~ 20	benign tumor	7 ~ 76 ♂ : 0 ♀ : 4	cheek : 2 lip : 2

Table 2. Clinical result of RDG.
Seventeen cases completely survived and three cases failed.

Case	Degree of survival	Reepithelial Period (weeks)	Rate of Contraction (%)
1	good	4	50
2	good	4	60
3	good	7	60
4	good	4	60
5	good	5	60
6	fair		
7	good	6	60
8	good	6	60
9	good	5	60
10	good	5	60
11	good	7	60
12	good	3	40
13	good	6	40
14	good	4	60
15	good	5	90
16	fair		
17	fair		
18	good	4	40
19	good	4	50
20	good	5	50
mean		5	55

ficial layer of the survived dermis showed spreading over the mucosal epithelium from the surrounding margin about 2 weeks after the graft operation, and was completely re-epithelialized in 5 weeks on average. An average of two years and 3 months after the operation, neither keratinization nor hair regrowth has been observed, and the texture of the grafted part is quite similar to the mucous membrane.

It was very difficult to examine the contraction of the grafted piece because the reconstructed part of the RDG did not make a scar around the margin of the grafted piece nor in the surrounding part. Therefore, contraction was estimated by measuring the trace of the graft margin, and it was found that the contraction was slight in the boney region as in the vestibular sulcus, while it was mucosa (Table 2). The overall mean contraction rate (final size of graft/original size graft) was 55%.

IV. CASE REPORTS

Case 3: A 9-year-old boy. The patient had a cheiloplasty operation for bilateral cleft lip and palate about 8 years ago, and had narrowing of the vestibular sulcus for scar (Fig. 3). The vestibuloplasty was performed by RDG. The adhesion of the alveolar ridge of the upper lip was resected, and a piece of the dermis, 6 × 4 cm, taken from the right inguinal region, was transplanted in an upside down manner (Fig. 4). The graft was fixed by the tie-over dressing for 10 days. The graft completely survived and was coated with fibrin membrane (Fig. 5). The sur-

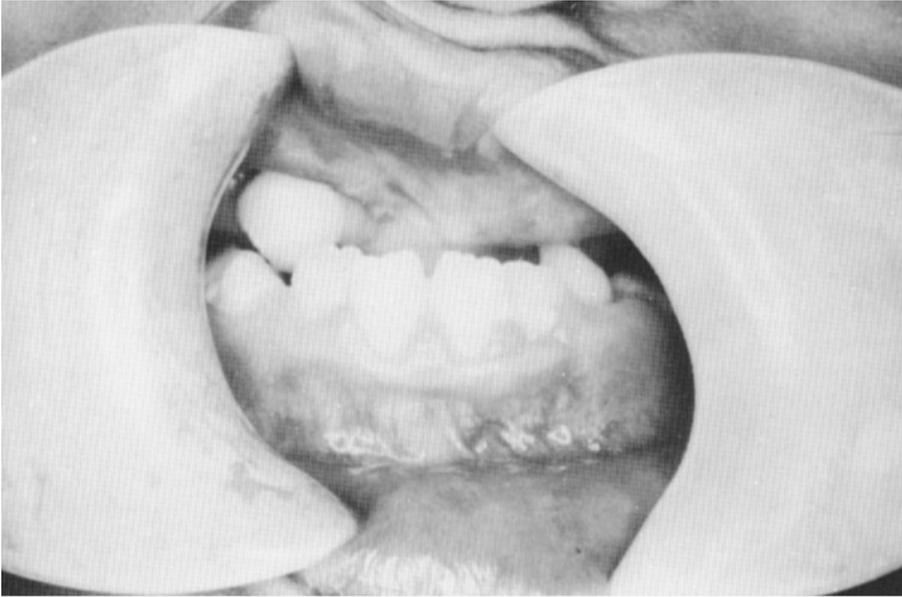


Fig. 3 Case 3: 9-year-old male. Bilateral cleft lip and palate. Vestibular sulcus of upper lip is narrow due to cheiloplasty for bilateral cleft lip and palate.

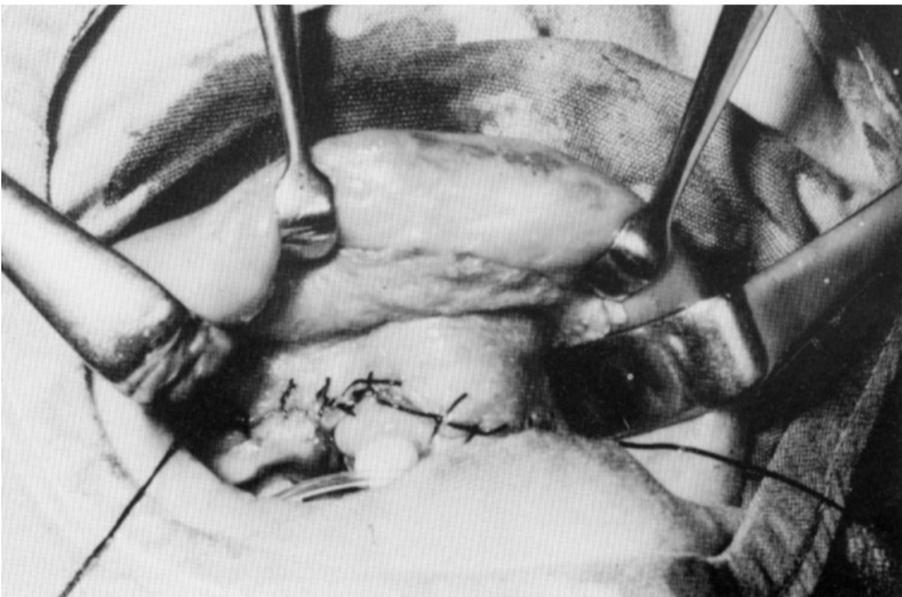


Fig. 4 The dermis was sutured upside down. Upper margin of the graft adhered to the bed with biological adhesive.



Fig. 5 The grafted dermis completely survived. The surface was covered with whitish-yellow fibrin membrane. Re-epithelialization started from the margin 2 weeks after the transplantation.



Fig. 6 The transplanted area. 2 years and 8 months after the operation. Keratinization and hair regrowth of the dermis are not seen.

rounding mucosal epithelium spread with in 2 weeks after the operation, and the graft was completely epithelialized. Two years and 8 months after the operation, no such abnormal finding as keratinization or hair regrowth is seen, and renewal of the mucosal tissue is evident (Fig. 6). Lip movement is good, and sufficient depth of the vestibular sulcus is maintained.

Case 11: A 57-year-old female. Tongue cancer. A tumor 15 X 10 cm in size with ulcer was discovered at the right margin of the tongue. Examination by biopsy revealed that the tumor was squamous cell carcinoma. Prior to the surgical operation, 50 mg of pepleomycin was administered. Radical dissection of the left neck, hemiglossectomy, and reconstruction by RDG were conducted.

Dermis, 8 X 5 cm in size, was taken from the inguinal region and was transplanted to the mucosal defect of the tongue and fixed by the tie-over method for 10 days. The transplanted graft completely survived, showing whitish-pink color (Fig. 7). Normal feeding was allowed 2 weeks after the operation, and no disturbance of re-epithelialization was found. Complete epithelium formed in about 6 weeks. The contraction rate 2 years after the operation was about 60%, and disturbance of the tongue movement was slight (Fig. 8).

Case 15: A 62-year-old male. Mandibular cancer. The patient underwent partial resection of the tongue, partial resection of the mandibular ridge, bilateral radical neck dissection, and D-P flap transplantation. The mandibular alveolar ridge was flattened, the vestibule was shallow, and a denture was impossible to install (Fig. 10).

However, the patient wanted a denture, so alveolarplasty was attempted. As a result of the X-P diagnosis, the height of mandibule was 25 cm in the center. Referring to Haerle's criteria,¹⁰⁾ whole mandibular plasty by RDG was performed and the following operation procedure was attempted. The top of the alveolar ridge was incised, and the mucous membrane was dissected to expose the mandibule. The mucosal flap was sutured to the vestibulo and lingual sulcus. The mandibule was covered with a layer of connective tissue. A piece of dermis 9 X 5 cm, taken from the right inguinal region, was transplanted in an upside down manner to the surface of the mandibule (Fig. 11). For the purpose of protecting the transplanted dermis, a splint was circumferentially wired to the mandibule for fixation. The fixed splint was removed 9 days after the operation, and good survival of the transplanted graft was obtained. Epithelialization was accomplished in 90% of the grafted dermis at the end of the 4th week (Fig. 12).

One month after the operation, the denture was set, and the adaptation of the denture base and the alveolar ridge was good and stabilization was excellent.

One year and 10 months after the denture installation, the alveolar ridge is sufficiently high, and no ulcer formation or keratinization is seen (Fig. 13). One year after the surgery, a biopsy specimen was taken from the reconstructed area. Figure 14 shows the histological findings. Parakeratosis was seen in the epithelial layer. Hair follicles and appendant organs were not seen in the dermis (Fig. 14).

V. DISCUSSION AND CONCLUSION

When intraoral reconstruction is attempted, functional reconstruction rather than cosmetic factors should be considered. Swallowing, digestion, and speech are essential for the patient in everyday life.

Conventionally, skin graft was the main strategy of unclear, and I think unnecessary reconstruction. However, according to the recent report of Hjørting-Hansen¹¹⁾ (1983), 55% of the patients who received conventional intraoral reconstruction with skin had such abnormal findings as hyperkeratosis and hair regrowth in the oral cavity. Such abnormalities have been the most typical problem of intraoral skin grafting.



Fig. 7 Case 11: 57-year-old female . Tongue cancer.
Tongue mucosa was reconstructed with RDG after hemiglossectomy.
The figure shows the grafted area 12 days after the operation.

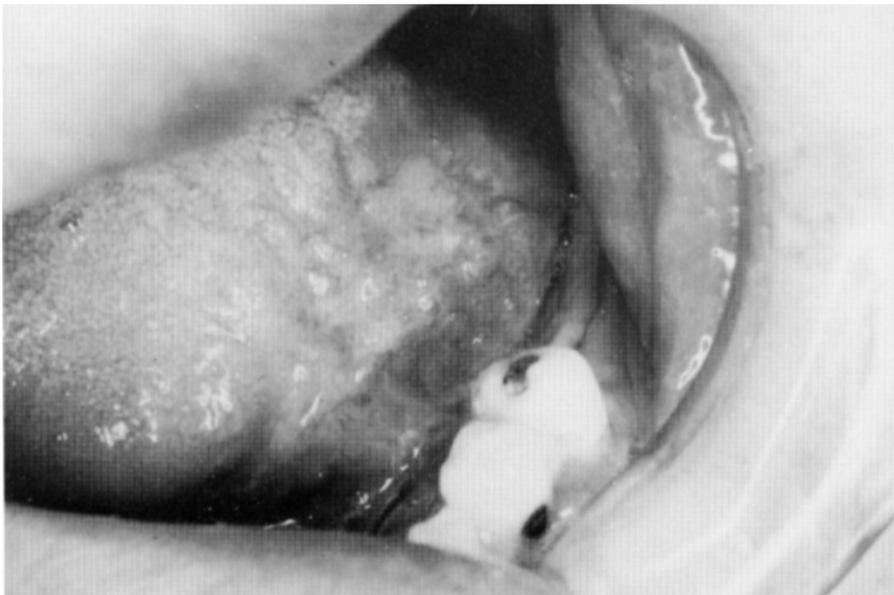


Fig. 8 Two years after the operation.
The contraction rate was about 60%. The texture of the reconstructed mucosa was soft and wet resembling the original tongue mucosa.

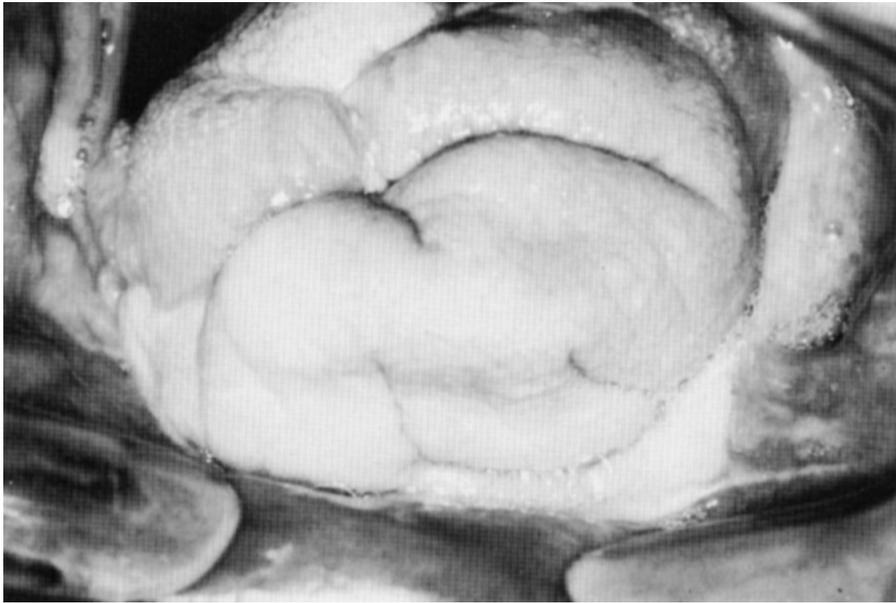


Fig. 9

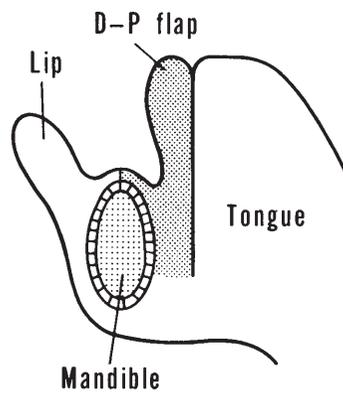


Fig. 10

Fig. 9, 10 Case 14: 62-year-old male. Mandibular cancer.
The alveolar ridge of the mandible was resected and flattened.

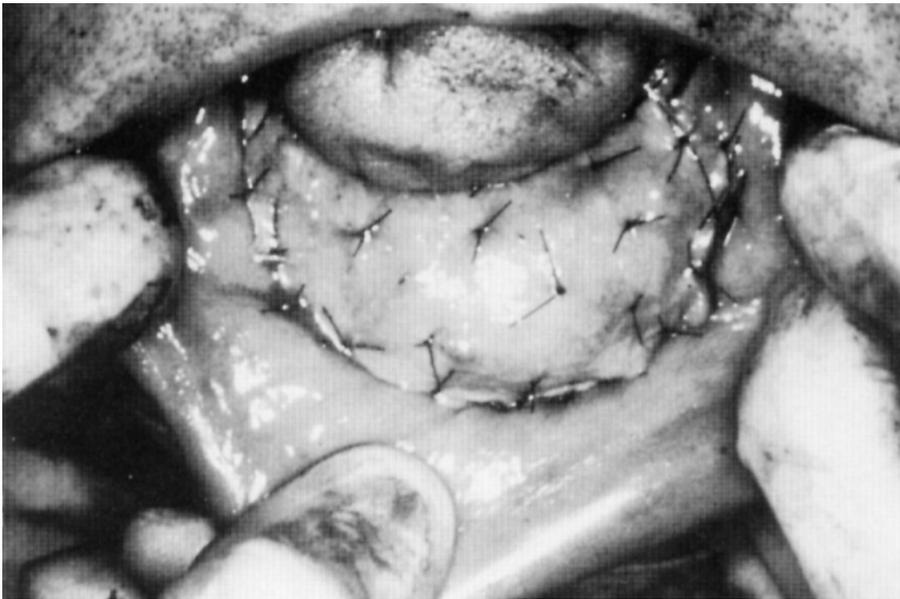


Fig. 11 Vestibulolinguo sucoplasty was carried out with RDG.



Fig. 12 Four weeks after the operation.
Epithelialization was accomplished in 90% of the dermis.

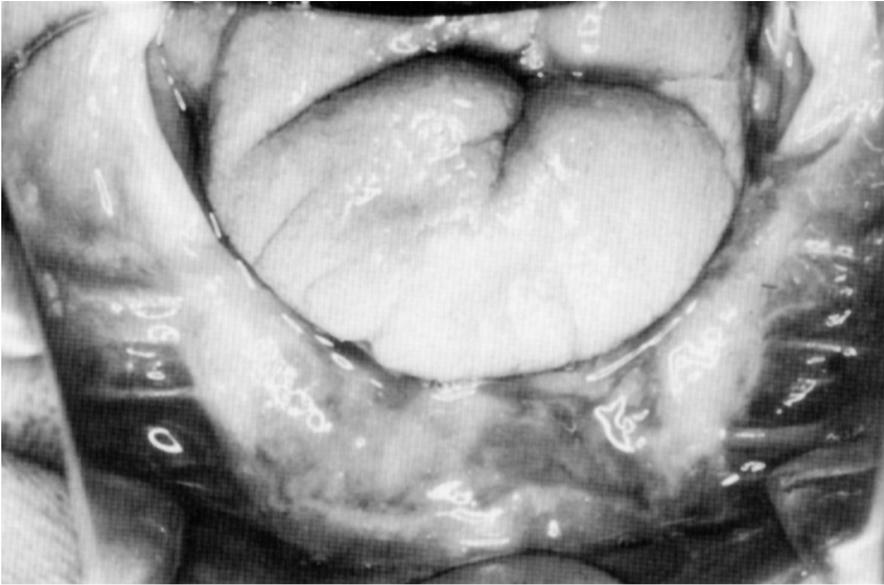


Fig. 13 One year and 10 months after the operation.
The alveolar ridge still keeps its original height. The surface of the alveolar ridge was very smooth and wet like mucosa.

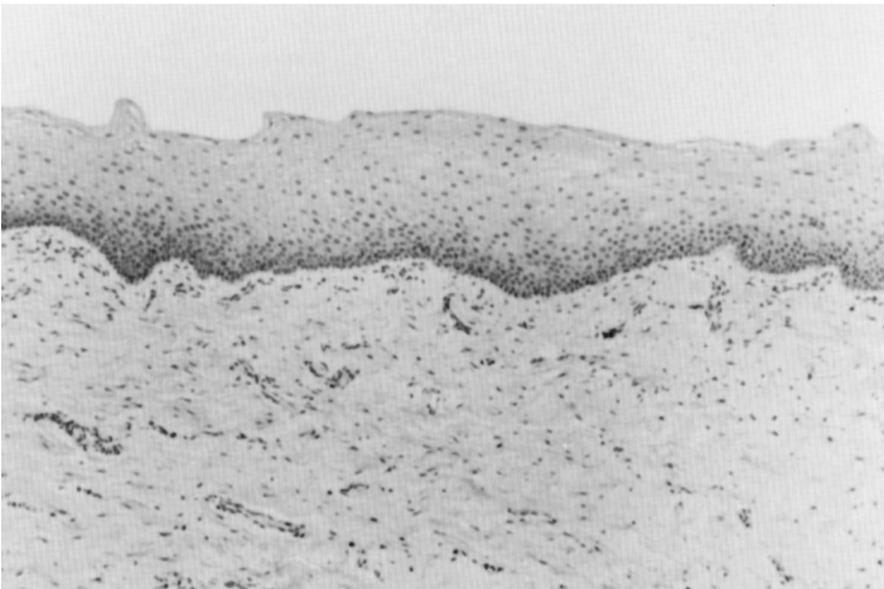


Fig. 14 Biopsy specimen taken from the alveolar ridge of case 14 a year after the operation.
($\times 80$, HE stain)

As mucosal grafting is superior to skin grafting in the texture of the grafted area, it should be performed for the intraoral reconstruction for ideal results¹²⁾. However, the availability of the mucosal graft is extremely limited in most cases. Thus, skin and mucous graftings are not satisfactory for perfect intraoral reconstruction, and a more advanced method is required.

The reversed dermis graft (RDG) was devised by us as the method to solve such a problem: i.e., the dermis of the skin taken from the inguinal region is transplanted in an upside down manner for the reconstruction of the defect part. When the dermis survives, contraction of the defect area is prevented and the surrounding mucous epithelium grows over the superficial dermis⁹⁾. Since the dermis is transplanted reversely, and the hair follicles and accessory organs are underneath the dermis when transplanted, they atrophy to metaplasia to the submucosal tissue. Therefore, when the RDG proposed here is used, availability of the graft is satisfactory and the intraoral tissue may be sufficiently reconstructed.

Clinical Application of RDG

The maximum area of RDG that we experienced was 9 × 5 cm, and this size of mucosal defect may be reconstructed by RDG. However, the larger the area to be reconstructed becomes, the longer the time required for re-epithelialization becomes, thus resulting in more contraction. The cause of the contraction may be that since the grafted skin lacks the epithelium, inflammation of the graft may continue for a longer period causing the contraction. The only shortcoming of the RDG, therefore, is that more contraction occurs than in the ordinary full-thickness skin graft. However, in our previous study¹³⁾, split thickness skin graft usually contracted to about half its original size in the oral cavity. When a bone bed is present, such as in the vestibular region, contraction is not notable and the RDG method is indicated for the reconstruction in such a region.

As shown above, the RDG method may be more satisfactory than the skin graft and mucosal graft for the reconstruction of the intra-oral defect.

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