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Original Research

A titanium screw-retaining temporary denture on the raw surface muscular flap for the immediate maxillary reconstruction



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ABSTRACT

Objective: In any immediate reconstruction of the maxillofacial defect after total maxillectomy, the defect is often covered with a flap, however, dentures cannot be maintained stably by the flap, because of the high mobility and large amount of displacement of the flap under pressure. Therefore, we developed a method in which a muscle flap is transplanted without creating a skin island in the oral cavity and a denture is immediately fixed with titanium screws, and obtained favorable results.

Patients and methods: The subjects were 9 patients who underwent resection for maxillary sinus cancer. In all patients, a free rectus abdominis muscle flap was used for the reconstruction and the raw surface of the muscle tissue was left in the oral cavity without creating a skin island. Dentures that had been made preoperatively were fixed on the remaining palate and alveolus with titanium screws for one month, so that they covered the muscle tissue.

Results: Good palatal morphology was formed without hanging down after epithelialization of the surface of the muscle tissue. In comparison with the preoperative levels, the masticatory and conversational functions recovered to 77% and 90%, on average.

Conclusions: Our method is considered to be one of the useful reconstruction methods for maxillofacial defects.

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1. Introduction

Various methods have been reported for the reconstruction of maxillofacial defects after total maxillectomy [1–7]. Defects of the

palate are often covered with free soft tissue grafts for reconstruction. However, this method has the problem that the flap hangs down due to gravity, and it is sometimes difficult to achieve stability of removable dentures on the flap, because of displacement of the flap by the applied pressure [2,4]. In order to resolve this problem, we developed the method of muscle flap transplantation without a skin island portion in the oral cavity combined with immediate placement of a denture fixed with titanium screws. Although the use of a simple bare muscle flap that was transplanted for transplantation in the oral cavity has already been reported [8], we were able to achieve morphological reconstruction without the hanging down of the flap by the support of the screw-retaining denture. Herein, we describe this method, and the good functional results

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Table 1
Characteristics of the patients.

Cases	Age (y)/Gender	Diagnosis/TNM classification (UICC)	Surgery
1	55/F	S.C.C ^a /(T4aN0M0)	Extended total maxillectomy
2	65/M	S.C.C/(T4aN0M0)	Extended total maxillectomy
3	56/M	S.C.C/(T4aN0M0)	Extended total maxillectomy
4	59/M	S.C.C/(T4aN0M0)	Total maxillectomy
5	43/M	S.C.C/(T3N2bM0)	Total maxillectomy
6	66/M	S.C.C/(T3N0M0)	Total maxillectomy
7	53/F	S.C.C/(T4aN0M0)	Extended total maxillectomy
8	43/M	A.C.C ^b /(T3N0M0)	Total maxillectomy
9	62/M	S.C.C/(T3N0M0)	Total maxillectomy

^a S.C.C.: squamous cell carcinoma.

^b A.C.C.: adenoid cystic carcinoma.

that we obtained in respect of the masticatory and conversational functions.

2. Patients and methods

The subjects were 9 patients who underwent resection for maxillary sinus cancer at our hospital during the 8-year period from April 2005 to March 2013. The mean age of the patients was 55.7 years; 7 subjects were male and 2 were female. All patients had stage III or IV advanced cancer. Extended total maxillectomy was performed in 4 patients and total maxillectomy in the remaining 5 patients (Table 1).

In all patients, a free rectus abdominis muscle flap was used for the reconstruction and the raw surface of the muscle tissue was left in the oral cavity without creating a skin island. The maxillary defect was filled with transplanted muscle as much as possible without dead space, and sutured to the remaining mucosa on the nasal, palatal and orbital floor side. If the orbital floor was reconstructed with a titanium mesh, it was covered with the fascia of the transplanted muscle. When the skin was resected or the orbit was exenterated concomitantly, the defect was covered with skin portions at these regions. After muscle transplantation, the morphology of the dentures that had been made preoperatively was modified with mucosal lining materials, and the dentures were fixed rigidly on the remaining palate and alveolar bone with titanium screws. The dentures were fixed for one month, while washing the bottom of the denture base from the border. Thereafter, when the screws were removed, after the surface of the muscle had already become epithelialized and an alveolar ridge with the same morphology as that of the denture base had formed. The final prosthesis was then newly made. If necessary, an implant was secondarily installed into the residual alveolar ridge to maintain the prosthesis. Before and after the operation, the masticatory function and conversational intelligibility were evaluated using Sato's masticatory score for Japanese [10] (Table 2) and Hirose's conversation function evaluation criteria [11] (Table 3), respectively. As for the type of maxillary defect and dentition after the tumor ablation, we used Brown's classification [6] and Eichner's classification [12], respectively. A representative case is shown below.

3. A concrete example

A 55-year-old woman with stage IV maxillary sinus cancer was treated by extended total maxillectomy. Immediate reconstruction was performed with a rectus abdominis muscle flap and a denture was fixed with titanium screws. Defects were filled with the rectus abdominis muscle tissue and the palatal defect was completely closed. The raw surface of the muscle tissue was left without creating a skin island (Fig. 1 A–C). The orbital defect was covered with

the skin portion of the flap (Fig. 2). A denture that had been made preoperatively was fixed on the remaining bone with titanium screws (Fig. 3). Screw fixation of the denture was maintained for a month after the muscle transplantation, and protecting the wound with the denture at rest prevented scar contracture. Ensuring continuous use of the denture induced formation of morphology similar to that of the normal alveolar ridge, and a good palatal morphology without hanging down was obtained even in the absence of bone lining. Three months after the operation, dental implants were inserted on the unaffected side. The transplanted muscle tissue was completely epithelialized by 7 months after the operation, and a reconstructed palate macroscopically similar to normal mucosa was obtained (Fig. 4). A stable final denture could eventually be made, because the muscle flap was displaced to a lesser extent under pressure due to the lower fat content without skin as compared to conventional flaps. The postoperative function was favorable (Fig. 5 A and B).

4. Results

Postoperative infection occurred in 2 patients (22%) and in one of them, the flap fell off. The overall success rate was 88.9%. One patient was rehabilitated using dental implants. Postoperative radiation was performed in 6 patients. The surface of the muscle flap was re-epithelialized in 4–9 months (Table 4). The masticatory and conversation functions recovered to $77.0 \pm 25.8\%$ and $89.9 \pm 5.35\%$, on average, respectively, as compared to the findings before the operation, indicating good functional results (Table 5).

Table 2
Sato's masticatory score.

	Food	
1	TOUFU	
	Rice	
	UDON Noodle	
2	Pudding	
	Lettuce	
	Shrimp TEMPURA	
	Cucumber	
3	Baked Rice Cake	
	Beef steak	
	Pickled Radish	
	Marinated Octopus	
	Hard Biscuit	
4	Millet and Rice Cake	
	Hard Rice Cracker	
	Cockle	
5	Hard Pickled Radish	Check as follows A: Easy to chew B: Difficult to chew C: Impossible to chew
	Dried Cuttlefish	
	Chewing gum	
	Whole apple	
	Cutting cotton thread	

Masticatory function score
(Number of A/20 × 100)

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