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EVALUATION OF SPEECH FUNCTION AFTER MESOPHARYNGEAL RECONSTRUCTION WITH RADIAL FOREARM FLAP

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KEY WORDS

speech function;mesopharyngeal reconstruction;forearm flap

ABSTRACT

This study examined postoperative speech function in ten patients who underwent mesopharyngeal resection and reconstruction using radial forearm flap. Patient age ranged from 49 to 71 years (mean 60 years) with 9 males and 1 female. Speech function was assessed by articulatory and velopharyngeal function. Articulatory function was judged by intelligibility of monosyllables and sentences. The percentage of 100 Japanese monosyllables perceived as correct in each case were scored. Intelligibility of sentences was evaluated using the Hirose standard. Velopharyngeal function was fiberoptically examined both in soft-blowing and at rest, and visual information about velopharyngeal closure was obtained. Correlation between the extent of resection and the speech function was then analysed. In order to maintain over 50% speech intelligibility and an excellent state in the Hirose standard, the extent of resection in the soft palate is particularly important. This result has to be explained in correlation with the resected range of the levator muscle, which is important for velopharyngeal closure. Surgically treated mesopharyngeal cancer patients face several functional problems. In order to counsel patients more meaningfully before surgical intervention, information about the postoperative speech function should be made available.

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The goal of reconstruction is to achieve acceptable speech in order to maintain the patients' quality of life. The results in this study reveal that resection which doesn't extend to the opposite side of the soft palate, can achieve the goal by utilization of the forearm flap, because its pliable nature brings out the residual function of the levator.

INTRODUCTION

In mesopharyngeal reconstruction after cancer ablation surgery, it is important to preserve the speech and swallowing functions to maintain the quality of life for the patient. Pedicled flaps, like deltopectoral,²⁾ forehead⁸⁾ and pectoralis myocutaneous³⁾ flaps have been used for reconstruction in mesopharyngeal defects. With the introduction of microsurgical techniques, various graft materials have been used successfully. Free flaps, such as radial forearm flap,¹⁰⁾ jejunum³⁾ and latissimus dorsi flaps⁵⁾ have all been frequently tried. Among these flaps, the forearm flap is well suited to replace oral mucosa for its pliable nature.¹⁰⁾ We also contend that in preventing post-operative dysfunctions, it is more important not to restrict the functioning of the residual tissue, rather than to focus on recreating the lost functions. From this viewpoint, we reconstructed mesopharyngeal defects in 10 cases using pliable radial forearm flaps. In order to counsel patients more meaningfully before surgical intervention, it is important to anticipate how the postoperative speech function will be affected. In a previous report,⁹⁾ post surgical oral and oropharyngeal cancer patients had variable speech function results, with different resection loci and types of reconstruction. Therefore, in assessing post operative function, it is important to match patients according to locus of resection and the method of reconstruction. In this study, the patients who had undergone mesopharyngeal resection with forearm flap reconstruction were grouped together by extent of resection, and their speech function was assessed based on the articulatory and velopharyngeal function.

SUBJECTS AND METHODS

Subjects

Ten patients who had undergone mesopharyngeal reconstruction with the radial forearm flap after cancer ablation surgery in the soft palate and lateral pharyngeal wall were examined. All patients had been treated at the Dept. of Otolaryngology Head and Neck Surgery, Kobe University Medical Center, and Hyogo Medical Center for Adults. Patient age ranged from 49 to 71 years (mean 60 years) with 9 males and 1 female. A summary of these patients is shown in table I. These 10 cases were classified into 4 groups according to the extent of surgical defect.

Group I : (Case 1 and 2) Only one side of the lateral pharyngeal wall was resected.

Group II : (Case 3,4 and 5) One side of the lateral pharyngeal wall and soft palate containing

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Table I . Summary of patients.

Case	Age	Sex	Primary lesion	TNM	Pre-op RT	Post-op RT
1	66	male	Retromolar trigone	T3N0	70Gy	
2	61	female	Retromolar trigone	T1N0		
3	60	male	anterior tonsillar pillar	T4N0	60Gy	
4	49	male	anterior tonsillar pillar	T4N0		50Gy
5	59	male	Tonsil	T3N2		60Gy
6	71	male	Tonsil	T3N1		50Gy
7	58	male	Tonsil	T3N1	56Gy	
8	56	male	Soft palate	T3N2		60Gy
9	61	male	Retromolar trigone	T1N0	135Gy	
10	59	male	Soft palate	T3N0		50Gy

Table II . Evaluation of speech.

Source: Japan society for head and neck cancer,ed.General rules for clinical and pathological studies on head and neck cancer, Tokyo.2nd ed.⁶⁾

Grade of intelligibility	score	
	A by family	B by non-family
understandable	5	5
occasionally not understandable	4	4
understandable when the topic is limited	3	3
occasionally understandable	2	2
not understandable	1	1

Judgement(A+B)

excellent: 10-8

moderate: 7-5

poor : 4-2

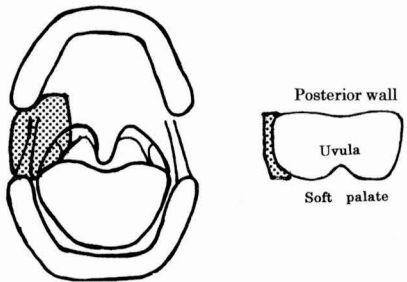
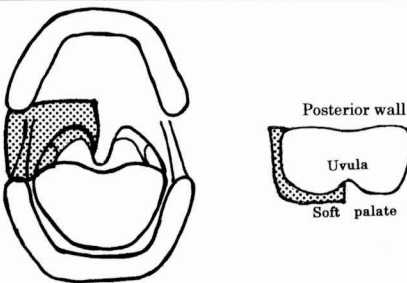
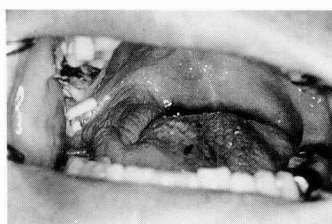
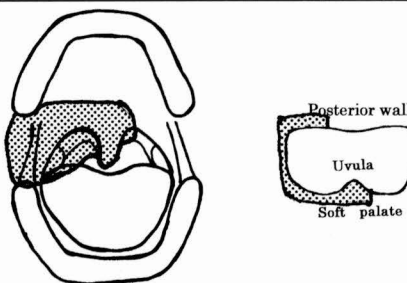
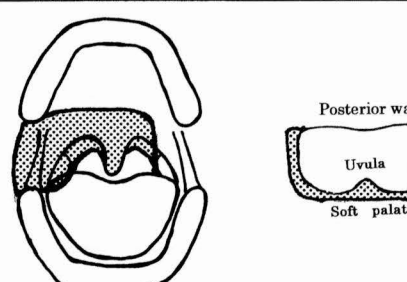
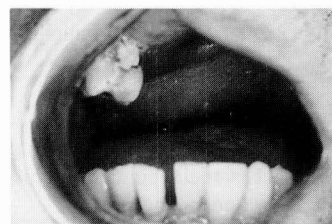
Group	Extent of surgical resection	Local findings
I		 Case 2
II		 Case 4
III		 Case 6
IV		 Case 9

Fig.1. The extent of surgical resection and local findings of each group.
Right figures:axial section of velopharyngeal port at the level of the uvula.
Left figures : peroral examination.

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part of the uvula, were resected.

Group III : (Case 6 and 7) One side of the lateral pharyngeal wall, soft palate containing the uvula, and part of the posterior pharyngeal wall, were resected.

Group IV : (Case 8,9 and 10) One side of the lateral pharyngeal wall and soft palate which reached beyond the uvula to the opposite side, were resected.

The extent of surgical ablation and postoperative intraoral findings in a representative case of each group are shown in figure 1.

Assessment of speech function

1. Articulatory function

1) Intelligibility of monosyllables

Recorded samples with 100 Japanese monosyllables were randomized and presented to 10 normal-hearing listeners, who phonetically judged each sample. The test was performed several times postoperatively.

2) Intelligibility of sentences

Patients and their families were interviewed and the speech function was evaluated according to the Hirose standard shown in Table II.

2. Velopharyngeal function

Velopharyngeal closure was fiberoptically examined in soft blowing and at rest, and recorded using a Sony VO-5800. To evaluate velopharyngeal closure, the still images obtained during soft blowing were compared with those taken at rest.

Results

RESULTS

1. Articulatory function

1) Intelligibility of monosyllables

The percentage of 100 Japanese monosyllables perceived as correct in each case postoperatively were plotted into a graphic form shown in fig.2. This figure shows the postoperative course of speech intelligibility. Speech intelligibility deteriorated immediately after the operation, and then remained steady from around six months later. For this reason, data of speech intelligibility in each case was collected after 6 months postoperatively and these results are shown in table III. The average percentage of correct monosyllables in group I was 80.5%. In group II, it was 82%; in group III, 58.5%; and in group IV, 36.7%.

2) Intelligibility of sentences

Intelligibility of sentences was evaluated using the Hirose standard⁶⁾ shown in table II. Seven cases which belonged to groups I, II and III were judged to show an excellent state, as shown in table IV. The three cases which belonged to group IV were judged to show a

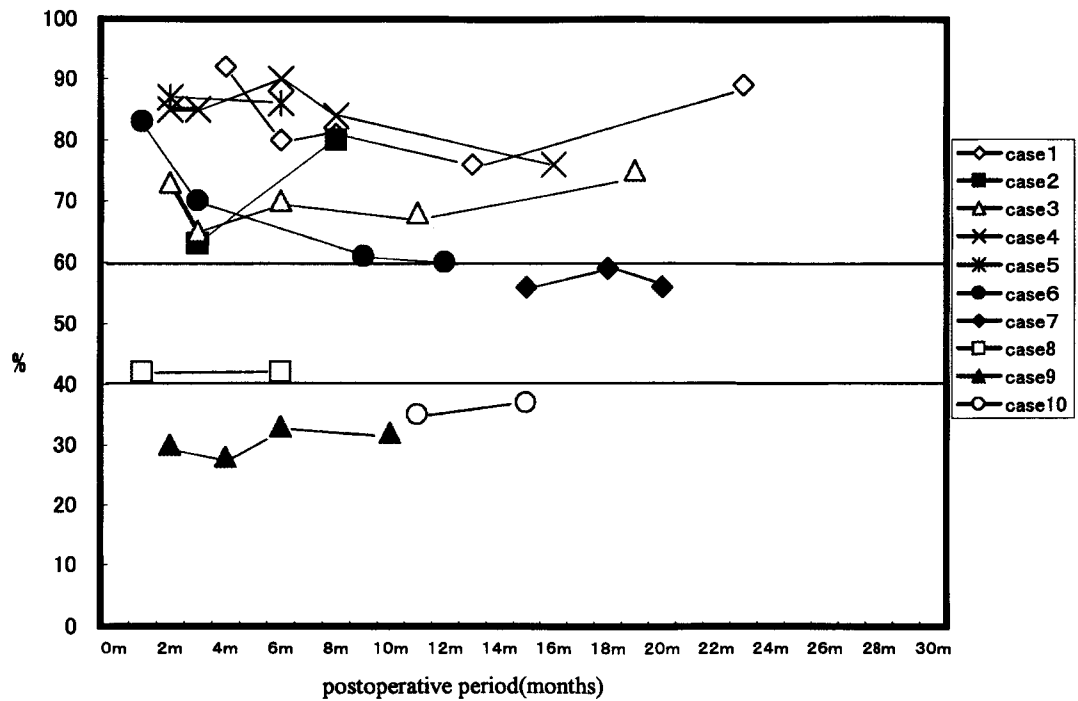


Fig.2. The postoperative course of speech intelligibility(%).

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Table III. Speech intelligibility of 100 Japanese monosyllables(%).

Speech intelligibility			
Group	Case	100syllables	Mean
I	1	81	80.5
	2	80	
II	3	70	82
	4	90	
	5	86	
III	6	61	58.5
	7	56	
IV	8	42	36.7
	9	33	
	10	35	

Table IV. Results of evaluation using the Hirose standard⁶⁾.

case	A	B	Total	Judgement
1	5	5	10	excellent
2	5	4	9	excellent
3	5	4	9	excellent
4	5	4	9	excellent
5	5	4	9	excellent
6	4	4	8	excellent
7	4	4	8	excellent
8	3	3	6	moderate
9	3	2	5	moderate
10	3	2	5	moderate

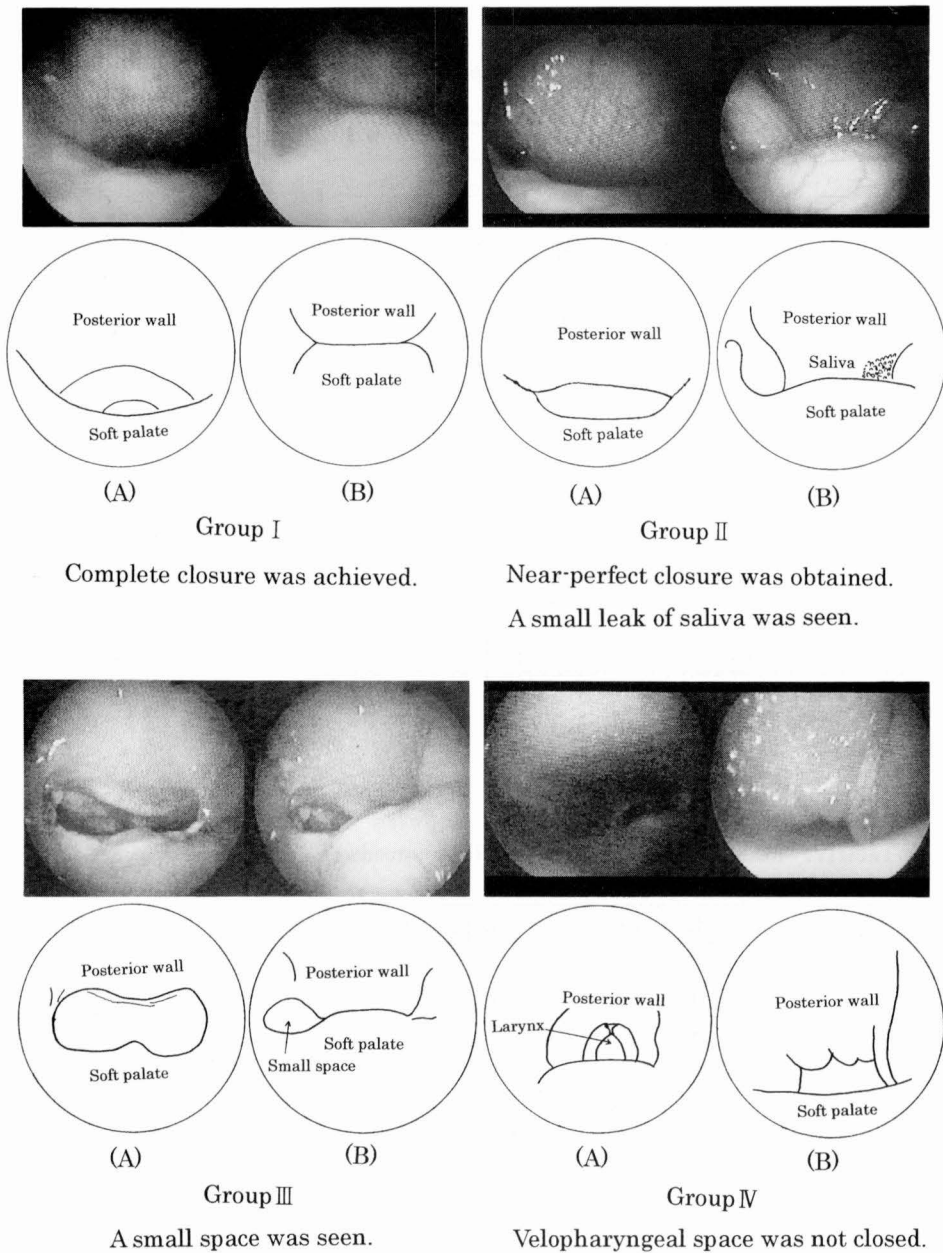


Fig.3. Velopharyngeal function at rest (A) and in soft- blowing (B).

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moderate state.

2. Velopharyngeal function

Evaluation of velopharyngeal closure was shown in fig. 3. In group I, the soft palate was domed and complete closure was achieved in soft blowing. In group II, near-perfect closure was obtained in soft blowing, although a small leak of saliva could be observed. In these groups, unaffected muscles moved the flap for complete to near-perfect closure. In group III, over half the nasopharyngeal space was closed with compensative movement of the unaffected soft palate, but a small space was evident in the side reconstructed with a free flap. In group IV, fold-like constriction was observed only in the posterior pharyngeal wall, and this provided little aid in obtaining velopharyngeal closure.

DISCUSSION

This study examined postoperative speech function in ten patients who underwent mesopharyngeal resection and reconstruction with the radial forearm flap. Speech function was assessed by articulatory and velopharyngeal function. The articulatory function was evaluated by the intelligibility of monosyllables and sentences. These data were examined to find the relationship between the extent of resection and the articulatory function. In group I and II, speech intelligibility was preserved to a level of over 80%. In group III, in which resection contained the uvula and posterior wall, speech intelligibility deteriorated to a level of less than 60%. However, in group IV, when the resection reached the opposite side of the soft palate, the speech intelligibility markedly deteriorated to a level of less than 40%. For intelligibility of sentences, only group IV was judged to show a moderate state while groups I, II, and III all achieved an excellent rating. These results indicated that the extent of resection in the soft palate had more impact on speech function than that in the lateral wall with or without posterior wall resection. To obtain the information about the movement of soft palate and pharyngeal wall, velopharyngeal closure was fiberoptically examined in soft blowing and at rest. From this examination, we can see that the residual muscle has no capacity to move the flap to close the velopharyngeal space, if the extent of resection reaches to the opposite side of the soft palate. This result is understood by keeping in mind the following anatomical mechanics. Velopharyngeal closure is obtained by contracting the levator veli palatini, tensor veli palatini, and superior pharyngeal constrictor muscles. Among these muscles, the most important muscle for velopharyngeal closure during speech is the levator.⁴⁾ The levator arises from the base of the skull and inserts into the palatine aponeurosis in the middle third of the soft palate. Therefore, to what extent the levator muscle is resected is an important key for velopharyngeal function. The cases classified into four groups in this paper were examined from this viewpoint. In group I, both sides of the levator were intact. In group II, only the affected side of the levator was resected, while the opposite side was left intact. In group III,

both sides of the levator were resected, however the insertion of the opposite side of the levator was sutured to the forearm flap used for the reconstruction. In group IV, both sides of the levator were resected, and the flap was sutured to the body of the levator. Since the grafted flap was immobile, only one side of the preserved levator could move the flap to attempt velopharyngeal closure. The above facts reveal that the speech function results from the extent of resection in the soft palate, especially the resected range of the levator which determines velopharyngeal closure. Surgically treated mesopharyngeal cancer patients face several functional problems. In order to counsel patients more meaningfully before surgical intervention, information about the postoperative speech function should be made readily available. The extent of resection in groups I and II allowed more than 80% speech intelligibility, which is of course sufficient for daily conversation. An examination of speech function after tonsil/base of tongue resection with primary closure has been reported.⁷⁾ In that study, the largest resection range was similar to that in our group II, while the smallest was smaller than that in our group I. Percent perceived correct occurrence of phonemes was reported as 80%. No difference was noted between the above result and ours in the intelligibility of monosyllables in group I and II, although they can't be compared simply. However, the results in the larger resections, similar to our groups III and IV, were not assessed. Group III patients, with a score of around 60%, did not have any trouble in conversation with their families and in telephone communication. Even in such a resection, by preserving the levator to suture its insertion to the grafted flap, fairly good velopharyngeal closure was obtained with good speech function. It was reported that 50% intelligibility after surgery demonstrated a severe functional impairment.⁹⁾ Therefore, maintaining over 50% of speech intelligibility is vitally important for the speech function. In groups I, II, and III this requirement was achieved. Unfortunately, in group IV resection, the lack of bilateral levator muscles with immobile grafted flap does not allow closing velopharyngeal space. The goal of reconstruction is to achieve acceptable speech intelligibility in order to maintain the patients' quality of life. The results obtained in this study disclose that resection, which doesn't extend to the opposite side of the soft palate achieves the goal by introducing the forearm flap, because its thin and pliable nature brings out the residual function of the levator.

CONCLUSIONS

- 1) Resection, which doesn't extend to the opposite side of the soft palate, results in sufficient speech intelligibility for daily life with the use of the forearm flap.
- 2) The levator muscle plays an important role in closing velopharyngeal space.
- 3) The forearm flap is valuable in reconstructing mesopharyngeal defects, due to its thin and pliable nature without restricting the construction of the residual levator.

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