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2003 6



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2/3

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(partial glossectomy)

(hemiglossectomy) . ,

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5 가 , Modified barium swallow  
(MBS) test, , 3 가 10

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2 가

3 cm

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**I.**

가 . , 가 2/3 가  
 (partial glossectomy) (hemiglossectomy) .

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가<sup>3,4</sup>

가<sup>3,5</sup>,

가<sup>6</sup>가 .

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2000 11 2002 11

가 Modified barium swallow (MBS) test,

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가 4 , T2 가 5 T4가 1 .  
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Table 1. Summary of cases

No.	T	Op	Approach	Tongue Volume(cm)	Reconstruction method	Flap Size(cm)	FFF/tongue (%)	Postop RTx	Start Diet (d)	Diet	Seal-up (d)
1	T1	P/G <sup>1</sup>	Peroral	4×3×1.4	Primary			No	8	GD	9
2	T1	P/G	Peroral	1.5×1.5×1.3	Primary			No	3	GD	-
3	T1	P/G	Peroral	2.5×2×1.2	Primary			No	6	SD	-
4	T2	H/G <sup>2</sup>	Pull-through	7.5×6×3	FFF <sup>4</sup>	10×8	178	Yes	20	SD	31
5	T2	H/G	Swing <sup>3</sup>	5.2×3.5×2.3	FFF	11×7	423	Yes	33	SD	34
6	T2	P/G	Swing	6×4×7	FFF	9×5	188	Yes	18	GD	15
7	T1	H/G	Pull-through	5.5×5×3	FFF	9×6	196	No	15	GD	17
8	T2	H/G	Swing	5×4×2	FFF	7×6	210	Yes	37	SD	38
9	T4	H/G	Segmental	5.5×4×1.5	FFF	8.5×8	309	Yes	28	GD	29
10	T2	P/G	Swing	6×3×3.3	FFF	9×5.5	275	Yes	14	GD	19

<sup>1</sup> partial glossectomy

<sup>2</sup> hemiglossectomy

<sup>3</sup> mandibular swing approach

<sup>4</sup> forearm free flap

2.7×2.2×1.3 cm,

5.8×4.6×2.7 cm 9×6.5

cm .

가 가

5.7 , 23.6 .

9 , 26.1 가 .

7 6 . (Table 2)

Table 2. Results according to reconstruction methods

	Primary closure (3) <sup>1</sup>	FFF(7)
Surgery	P/G	P/G (2), H/G (5)
Approach	Peroral	Pull-through (2), Swing (4), segmental (1)
Defect size (average : cm)	2.7×2.2×1.3	5.8×4.6×2.7
Flap size (average : cm)		9×6.5
Start oral diet (d)	5.7	23.6
Diet	more than SD	more than SD
Seal-off (d)	9 (1)	26.1
RTx	No	Yes (6), No (1)

(<sup>1</sup>) Number of patients

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가 50

(speech intelligibility score),

(articulation score),

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(diadochokinetic test: DDK),

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(Table 3)



Table 3. Speech intelligibility score (Teichgraeber, 1986)

Score	Speech intelligibility
7	No sound errors are noticed in continuous speech
6	Sounds errors are occasionally noticed in continuous speech
5	Speech is intelligible, although noticeably in error
4	Speech is intelligible with careful listening
3	Speech intelligibility is difficult
2	Speech is usually unintelligible
1	Speech is unintelligible

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7

7. (Table 4)

Table 4. Articulation score (Panchal, 1996)

Score	Articulation
7	Within normal limit
6	Mild-slight distortion and imprecision of consonants only
5	Mild to moderate-all consonants targeted
4	Moderate-at least 2 consonants placements acoustically distant from the target (e.g. k=t, s=th, ch=t)
3	Moderate to marked-consonants and vowels both affected
2	Marked-uses adaptive compensatory articulation for all lingual consonants
1	Severe-does not use effective compensatory articulations

(bilabialis: ㅁ,ㅂ,ㅃ,ㅍ), (lingua alveolars: ㄴ,ㄷ,ㄸ,ㄹ,ㄱ,ㅅ,ㅆ,  
 ㅈ), (lingua palatals: ㅊ,ㅌ,ㅍ), (lingua velars: ㄱ,ㅋ,ㆁ,ㅇ),  
 (glottis: ㅎ) , (plosives:  
 ㄱ,ㅋ,ㆁ,ㄷ,ㄸ,ㅌ,ㅍ,ㅃ,ㅍ,ㅇ), (fricatives: ㅅ,ㅆ,ㅎ), (affricatives: ㅈ,ㅊ,  
 ㅊ), (laterals: ㄹ), (nasals: ㄴ,ㅁ,ㅇ) <sup>3.5.</sup>

(Table 5)

Table 5. Classification of consonants (Teichgraeber, 1986; Stenson, 2000)

Articulation Method	Articulation location				
	Bilabialis	Alveolars	Palatals	Velars	Glottis
Plosives	ㅁ,ㅂ,ㅃ	ㄴ,ㄷ,ㄸ		ㄱ,ㅋ,ㆁ	
Fricatives		ㅅ,ㅆ			ㅎ
Affricatives			ㅈ,ㅊ,ㅌ		
Laterals	ㄹ	ㄴ		ㅇ	
Nasals		ㄴ			ㅇ

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3.5.8.

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8 가

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Logemann<sup>9</sup>

MBS test

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(swallowing ability)

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가

MBS

test

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10cc

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(paste)

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(lateral sulcus)

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(bolus)

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(delayed

swallowing reflex),

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2,4,6,10. (Table 6)

Table 6. Modified barium swallow test findings (Stenson, 2000; Pauloski, 1998; Furia, 2000)

Stage	Findings
Oral stage	Labial closure
	Rotatory lateral movement of tongue
	Seal off lateral sulcus
	Food propelling posteriorly
	Swallowing reflex
	Stasis in oral cavity
Pharyngeal stage	Pharyngeal transit time
	Closure of velopharyngeal port
	Pharyngeal wall peristalsis
	Stasis in vallecula
	Laryngeal elevation
	Laryngeal closure
	Cricopharyngeal dysfunction
Aspiration before / during / after swallowing	

, 14 가

3.5,11,12, (Table 7)

Table 7. Deglutition test

(Teichgraeber, 1986; Teichgraeber, 1985; Zelefsky, 1996; Haribhakti 1993)

Deglutition test	
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Table 8. Swallowing ability (Teichgraeber, 1986; Stenson, 2000; Teichgraeber, 1985)

Score	Swallowing ability
7	Within normal limit
6	Within functional limit : abnormal oral and pharyngeal stage, regular diet
5	Mild impairment : mild dysfunction of oral & pharyngeal stage, need of modified diet
4	Mild-moderate impairment: mild dysfunction in oral & pharyngeal stage, modified diet & need of therapeutic and preventive procedure
3	Moderate impairment : moderate dysfunction in oral & pharyngeal stage, aspiration, modified diet & need of therapeutic and preventive procedure
2	Moderate severe dysfunction and need of supplemental enteral feeding, moderate dysfunction in oral & pharyngeal stage, aspiration, modified diet & need of therapeutic and preventive procedure
1	Severe impairment dysfunction NPO and need of primary enteral feeding, inadequate oropharyngeal transit, significant aspiration

1.

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. (Table 9)

Table 9. Results of speech function according to reconstruction methods

		Primary closure (n=3)	FFF (n=7)
Intelligibility score		6.7±0.6	5.0±0.9
Articulation score		7.0±0.0	5.2±0.9
Predominant error	Location	Lingua alveolars ㄱ, ㄴ (mild)	Alveolars, palatals, velars ㄱ, ㄴ, ㅈ, ㅊ, ㅌ, ㄷ, ㄹ, ㅍ, ㅋ
	Method	Fricatives	Fricatives, affricatives, laterals
DDK (times/ 5 sec)		30.7±3.1	32.3±1.7
		32.3±4.5	30.0±5.6
		29.7±3.2	23.3±5.0
		15.0±1.7	16.8±1.0
		14.3±4.5	16.0±1.6
		15.0±2.6	17.3±4.4
		10.7±1.5	10.3±2.2
Tongue mobility Score	Straight out	6.0±1.0	3.7±1.1
	To upper teeth	6.7±0.6	3.3±2.1
	To palate	7.0±0.0	3.4±2.6
	Curled back	7.0±0.0	3.3±2.4
	Lateralize	7.0±0.0	3.9±1.9
	Elevate	7.0±0.0	4.1±2.3
	Depress	7.0±0.0	5.0±1.3
	Clear palate of food	6.7±0.6	4.4±2.1



MBS test

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. (Table 10)

Table 10. Results of swallowing function according to reconstruction methods

Stage	Findings	Primary (n=3)	FFF (n=7)
Swallowing ability		7±0.0	5±1.2
Oral stage	Labial closure	100 %	100 %
	Rotatory lateral movement of tongue	100 %	29 %
	Seal off lateral sulcus	100 %	71 %
	Food propelling posteriorly	100 %	71 %
	Swallowing reflex	100 %	14 %
	Stasis in oral cavity	0 %	100 %
Pharyngeal stage	Pharyngeal transit time (s)	700±0.0	833±535
	Closure of velopharyngeal port	100 %	86 %
	Pharyngeal wall peristalsis	100 %	43 %
	Stasis in vallecula	0 %	100 %
	Laryngeal elevation	100 %	71 %
	Laryngeal closure	100 %	71 %
	Cricopharyngeal dysfunction	0 %	14 %
	Aspiration	0 %	43 %
Deglutition test	type of diet	more than semisolid	more than semisolid
	meat	100 %	86 %
	vegetable	100 %	86 %
	salad	100 %	86 %
	thin liquid	100 %	100 %
	with fluid	33 %	57 %
	grain food	100 %	0 %
	stasis	33 %	100 %
	food temperature	33 %	43 %
	duration of meal (m)	21.7±7.6	25.7±9.8
	public restaurant	100 %	14 %
	taste and appetite	100 %	0 %

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T2

5.8×4.6×2.7 cm

9×6.5 cm

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(Table 11)

Table 11. Results of speech function by volume ratio

Flap / tongue defect ratio		< 2.0 (n=3)	≥ 2.0 (n=4)	
Start diet (d)		17.7±2.5	28.0±9.0	
Seal-up (d)		21.2±8.7	30.0±8.2	
Intelligibility score		5.3±0.6	4.7±1.2	
Articulation score		5.3±0.6	4.7±0.6	
DDK		33.5±0.7	31.0±1.4	
		33.0±2.8	27.0±7.1	
		27.0±4.2	19.5±0.7	
		17.5±0.7	16.0±0.0	
		17.0±1.4	15.0±1.4	
		21.0±1.4	13.5±0.7	
		12.0±1.4	8.5±0.7	
	Tongue mobility	Straight out	4.0±1.0	3.5±1.3
		To upper teeth	4.3±1.2	3.8±2.8
		To palate	4.3±2.5	2.8±2.9
Curled back		4.0±2.6	2.8±2.4	
Lateralize		4.3±2.1	3.5±1.9	
Elevate		5.3±1.5	3.3±2.5	
Depress		3.7±0.6	5.3±1.7	
Clear palate of food		5.3±1.2	3.8±2.5	

	MBS test	2	
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	2	2	

. (Table 12)

Table 12. Results of swallowing function by volume ratio

Flap / tongue defect ratio		< 2.0 (n=3)	≥ 2.0 (n=4)
Swallowing ability		6.0±1.0	4.3±0.5
Oral stage	Complete labial closure	100 %	100 %
	Complete rotatory movement	33 %	25 %
	Complete seal off lateral sulcus	100 %	50 %
	Complete food propelling posteriorly	67 %	75 %
	Intact swallowing reflex	33 %	0 %
	Stasis in oral cavity	100 %	100 %
Pharyngeal stage	Pharyngeal transit time (s)	611±246	1000±668
	Complete closure of velopharyngeal port	100 %	75 %
	Complete pharyngeal peristalsis	67 %	25 %
	Stasis in vallecula	100 %	100 %
	Complete laryngeal elevation	100 %	50 %
	Complete laryngeal closure	100 %	50 %
	Cricopharyngeal dysfunction	0 %	25 %
Deglutition	Aspiration	0 %	75 %
Test	type of diet	solid	semisolid
	meat	100 %	75 %
	vegetable	100 %	75 %
	salad	100 %	75 %
	thin liquid	100 %	100 %
	with fluid	33 %	75 %
	grain food	0 %	0 %
	stasis	100 %	100 %
	food temperature	67 %	25 %
	duration of meal (m)	26.7±15.3	25.0±5.8
	public restaurant	33 %	0 %
	taste and appetite	0 %	0 %

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7,14,15.

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MBS test

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(positive feedback)

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T1

1 cm ~ 1.5 cm

(tethering)

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3 cm

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17.

T2

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(adynamic)



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MBS test

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3 cm

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Abstract

Postoperative assessment of speech and swallowing functions in oral tongue cancer

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Partial glossectomy or hemiglossectomy is the treatment of choice in the early stage of the oral tongue cancer because the most common site is anterior two-third of the lateral border of the oral tongue. The reconstruction methods such as secondary healing, primary closure, skin graft, local or regional flap and distant free flap have been used to reconstruct the defect of the oral tongue. Sometimes the oral cavity functions such as swallowing and articulation may be seriously disabled after surgery despite excellent reconstruction. So, preservation of the functions and oncologic resection of cancer in the treatment of oral tongue cancer are challenging problems for head and neck surgeon.

We evaluated speech and swallowing functions in postoperative stage in the patients with oral tongue cancer to help predict the postoperative status of speech and swallowing according to the size of defect and the reconstruction methods.

In the oral tongue cancer patients treated by surgery as initial management, speech function tests (speech intelligibility score, articulation score, predominant class of errors, diadochokinetic test, and tongue mobility test) and swallowing function tests (MBS test, deglutition test, and swallowing ability score) were performed and reviewed operation findings.

In the primary repair group, the speech and swallowing function test was nearly normal except mild mis-articulation of the lingua alveolars. In the free flap group, the speech function was intelligible despite impaired tongue mobility and mis-articulation of the lingua alveolars, the lingua palatals and the lingua velars. Impaired lateral tongue movement, marked stasis in oral cavity, delayed swallowing reflex on MBS test resulted in decreased pharyngeal peristalsis, stasis in vallecula, incomplete laryngeal closure and elevation and aspiration. Swallowing ability was also impaired.

In less over-reconstructed group according to tongue defect and reconstruction volume ratio, much earlier oral diet start, seal-up and more excellent speech and swallowing function were observed because a dynamic portion was relatively small.

We observed that the postoperative speech and swallowing functions were not affected in the

group with less than 3 cm of the tongue defect and the reconstruction with primary closure. The lingua alveolars were mainly affected on postoperative speech evaluation in primary closure and free flap group irrespective of defect volume. Speech function and swallowing functions in less over-reconstructed group were superior to those in over-reconstructed group

We will consider that this study aids in counseling the patients and predicting the postoperative status of speech and swallowing function according to the size of primary defect and the reconstruction methods. For better prediction of the postoperative functional status, we should need plans of prospective functional evaluations and comparison assessments of the preoperative and postoperative status are needed.

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Key Words : oral tongue, speech function, swallowing function, reconstruction