Supraomohyoid Neck Dissection in the Management of Oral Squamous Cell Carcinoma: Special Consideration for Skip Metastases at Level IV or V

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Purpose: The aim of this study was to evaluate the therapeutic safety and prognosis of supraomohyoid neck dissections for oral squamous cell carcinoma, with a special focus on the risk of skip metastases in level IV or V.

Materials and Methods: A retrospective study was conducted of 637 patients with oral squamous cell carcinoma who were admitted to the department of oral and maxillofacial surgery from September 1995 through July 2010. After completing a diagnostic evaluation, all patients underwent surgery (wide primary excision with supraomohyoid neck dissection, extended supraomohyoid neck dissection, or modified radical or radical neck dissection) and were followed periodically.

Results: Levels I, II, and III were the most common sites of occult metastasis. Skip metastases alone at level IV or V and any neck recurrence at level IV or V were not found. Three-year neck recurrence-free survival and disease-specific survival were not significantly different among the patients who underwent supraomohyoid neck dissection, extended supraomohyoid neck dissection, or modified radical or radical neck dissection owing to cN0 to cN^+ disease.

Conclusions: The rate of skip metastasis at level IV or V is very rare and is very difficult to diagnose accurately. The results of this retrospective study show that supraomohyoid neck dissection for oral squamous cell carcinoma is an appropriate treatment.

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Lymph node metastases are the most important prognostic factor in head and neck cancer.[1,2] Studies of lymphatic drainage have shown that most regions of the oral cavity drain to neck levels I to III.[3,4] Therefore, in oral cancer, selective neck dissection (SND) is generally advocated for N0 disease and cautiously for N1 or N2a disease.[5,6] However, there is controversy over which nodal levels should be removed, focusing especially on levels IV and V.[7] The occurrence of occult metastases to lower levels in the neck (levels IV and V) or the development of an erratic distribution of cervical metastases ("skip metastases") that bypass the upper neck levels (levels I to III) and go directly to level IV or V challenges the role of supraomohyoid neck dissection (SOND) in the treatment of oral squamous cell carcinoma (OSCC).[8,9] Many surgeons accept that extended SOND (ESOND), which includes level IV, could decrease the regional recurrence rate up to 10% for patients with

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cN0 neck tumor.[10,11] Most surgeons support a modified radical or radical neck dissection (MRND/RND) for the basic management of disease in patients with cN^+ neck tumors.[12] However, some recent research has shown that the rate of skip metastases in oral cancer is very low and that even patients with N^+ neck tumors should undergo SOND.[13]

It is important to understand the pattern of lymphatic spread in oral cancers so that the best surgical treatment can be selected to optimize oncologic clearance. The present study determined the pattern and incidence of predictable lymphatic spread and skip metastases in OSCC and provided the prognostic implications of different therapeutic modalities for neck metastases.

Materials and Methods

The institutional review board of the Stomatological Hospital of Peking University (Beijing, China) approved this study. Owing to the retrospective nature of this study, it was granted an exemption in writing by the institutional review board. From September 1995 through July 2010, inpatients who underwent a neck dissection at the Department of Oral and Maxillofacial Surgery, Stomatological Hospital, Peking University for pathologically diagnosed SCC were screened for this study. Patients' inclusion criteria included *1)* a primary tumor located on the tongue, gingiva, buccal, floor of the mouth, or hard palate; *2)* a history of neck dissection; *3)* no distant metastases present; *4)* no previous treatment; and *5)* availability of the patient's complete medical information and follow-up data. Identifier data were terminally coded to maintain a patient's anonymity.

All patients initially underwent surgical treatment. The surgical procedure for neck dissection included SOND (levels I to III), ESOND (levels I to IV), and MRND/RND (levels I to V). In addition, postoperative patients were advised to return regularly for visits at intervals of 2 months during the first year, 3 months in the second year, 6 months in the third, fourth, and fifth years, and once every 6 months to 1 year thereafter. Survivors completed a telephone interview every 6 months. This follow-up policy is routine practice at the authors' hospital.

Metastases found at different levels were separated for analysis. The sides and levels of the tumors were determined using landmark sutures that were placed after the removal of the primary tumor. Standard hematoxylin and eosin staining was examined. Skip metastasis was defined as disease that bypassed levels I and II and went directly to level III, IV, or V. This definition was based on the proposition by Byers et al.[8] For those patients who had pN^+ neck, postoperative radiotherapy (RT) to the neck was advised.

The baseline demographic data of the 3 groups were compared using a χ^2 test as appropriate for categorical variables. The main outcome assessment parameter was 3-year neck control rate (NCR), which was defined as the percentage of patients who did not develop postoperative nodal metastasis alone within 3 years of surgery. The secondary outcome assessment parameter was the 3-year disease-specific survival (DSS), which was calculated from the time of the first operation to the time of death or last follow-up. Kaplan-Meier curves for 3-year NCR and DSS were generated for each group and compared using the log-rank test. Cox proportional hazard models were used for multivariate analyses of baseline factors with 3-year NCR and DSS. *P* values less than .05 were considered statistically significant. All statistical analyses were performed using SPSS 17.0 for Windows (SPSS, Inc, Chicago, IL).

Results

PATIENT CHARACTERISTICS

In total, 637 eligible patients were enrolled at random in this study (355 men and 282 women; mean age, 58.6 yr; age range, 19 to 87 yr). The demographic data of the 637 patients are presented in Table 1. The cutoff date for obtaining follow-up data for the surviving patients was July 31, 2013. The median follow-up for these patients was 68 months (interquartile range, 48 to 95 months).

All 637 patients who underwent unilateral neck dissections were divided into 3 groups (MRND/RND group, 248 cases; ESOND group, 64 cases; SOND group, 325 cases). In total, 447 patients preoperatively had cN0 necks (MRND/RND, 147 cases; ESOND, 43 cases; SOND, 257 cases). Of these cN0 necks, a histologic examination of neck dissection specimens showed occult metastasis in 127 patients (28.4%). Another 190 patients had cN^+ necks (MRND/RND, 101 cases; ESOND, 21 cases; SOND, 68 cases). Of these cN^+ necks, lymph node metastasis was found in 147 patients (77.4%). The modality of neck dissections and clinical tumor and nodal staging of tumors are listed in Table 2.

NO SKIP METASTASIS ALONE TO LEVEL IV OR V OBSERVED FOR PATIENTS WITH cN0 NECKS

After analyzing the nodal status of all 447 patients with a cN0 neck, the highest rate of occult metastasis was found at level II. Level II was involved in 74 of 447 cases (16.6%), level I in 67 of 447 cases (15.0%), and level III in 16 of 447 cases (3.6%). Skip metastasis to level III was found in only 5 of the 447 patients (1.1%), including the tongue in 3 cases and the inferior gingiva in 2 cases. After analyzing the 190 patients with cN0 neck in the ESOND and MRND/RND groups, nodal metastasis to level IV was found in 6 of 190 cases (3.2%). Skip metastasis to level IV was observed only coupled with skip metastasis to level III in 1 of 190 cases (0.5%; pT3N2bM0 stage tongue cancer). No skip metastasis to level IV alone was observed. Analysis

Table 1. BASELINE DEMOGRAPHICS OF 637 PATIENTS WHO PARTICIPATED IN THIS STUDY

	SOND Group (n = 325)		ESOND Group (n = 64)		MRND/RND Group (n = 248)		
Variables	n	%	n	%	n	%	*P* Value
Age (yr)							
<60	149	45.8	33	51.6	133	53.6	.171
≥60	176	54.2	31	48.4	115	46.4	
Gender							
Male	180	55.4	31	48.4	144	58.1	.384
Female	145	44.6	33	51.6	104	41.9	
Site							
Tongue	137	42.2	28	43.8	110	44.4	.281
Inferior gingiva	60	18.5	14	21.9	62	25.0	
Buccal	62	19.1	9	14.1	41	16.5	
Floor of mouth	19	5.8	5	7.8	17	6.9	
Maxillary gingiva	35	10.8	5	7.8	15	6.0	
Hard palate	12	3.6	3	4.6	3	1.2	
Pathologic grade							
I	179	55.1	36	56.2	117	47.2	.360
II	124	38.2	25	39.1	114	46.0	
III	22	6.7	3	4.7	17	6.8	
Smoking history							
Smoker	122	37.5	27	42.2	112	45.2	.170
Nonsmoker	196	60.3	34	53.1	131	52.8	
Missing	7	2.2	3	4.7	5	2.0	
Alcohol history							
Drinker	95	29.2	22	34.4	86	34.7	.313
Nondrinker	224	68.9	39	60.9	157	63.3	
Missing	6	1.9	3	4.7	5	2.0	

Abbreviations: ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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of the nodal status of 147 cases in the MRND/RND group showed no skip metastasis to level V (Table 3).

NO SKIP METASTASIS ALONE TO LEVEL IV OR V WAS OBSERVED IN PATIENTS WITH cN$^+$ NECK

The prevalence rates of nodal metastasis in the cN$^+$ neck were 51.1% (97 of 190), 48.4% (92 of 190), 18.4% (35 of 190), 7.4% (9 of 122), and 6.9% (7 of 101) for levels I, II, III, IV, and V, respectively. Skip metastases to level III in the cN$^+$ group were observed in 4 of 190 patients (2.1%), which included the tongue in 2 cases, the inferior gingiva in 1 case, and the maxillary gingiva in 1 case. There were no skip metastases to level IV or V because only the associated metastatic involvement of the preceding level I, II, or III node occurred.

ANALYSIS OF NECK RECURRENCE AND TREATMENT FOR DIFFERENT MODALITIES OF NECK DISSECTION

Forty-one patients (9.2%) in the cN0 group (SOND, 19 cases; ESOND, 6 cases; MRND/RND, 16 cases) developed nodal recurrence alone without associated local recurrence or distant metastasis. Specifically, the distribution of neck recurrence was as follows: of the 19 patients in the SOND group, there were 14 ipsilateral recurrences (73.7%), 4 contralateral recurrences (21.1%), and 1 bilateral recurrence (5.3%); of the 6 patients in the ESOND group, there were 3 ipsilateral recurrences (30.0%), 2 contralateral recurrences (33.3%), and 1 bilateral recurrence (16.7%); and of the 16 patients in the MRND/RND group, there were 10 ipsilateral recurrences (62.5%) and 6 contralateral recurrences (37.5%). All patients with cN0 neck were followed for 3 to 18 years, and no nodal recurrence alone at level IV or V was found. The distribution of neck recurrence by tumor stage in the cN0 group is presented in Table 4. In this study, the tumor stage distribution was unequal among the 3 neck treatment modalities. Therefore, to analyze the 3-year NCR, the patients were divided further into 2 groups according to tumor stage: early-stage disease (T1 to T2) and advanced-stage disease (T3 to T4). There were no statistically significant differences in patients with early-stage disease who received SOND, ESOND, or MRND/RND

Table 2. MODALITY OF NECK DISSECTIONS AND CLINICAL TUMOR AND NODAL STAGING OF TUMORS IN THIS STUDY

	cN0 Neck (n = 447)				cN^+ Neck (n = 190)				
Modality of Neck Dissections	T1	T2	T3	T4	T1	T2	T3	T4	Total
SOND	79	107	31	40	8	29	8	23	325
ESOND	10	20	5	8	2	7	2	10	64
MRND/RND	24	66	20	37	5	36	12	48	248

Abbreviations: cN0, clinically negative node; cN^+, clinically positive node; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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(3-year NCRs, 93.0% for the SOND group, 86.7% for the ESOND group, 93.3% for the MRND/RND group; P = .464; Fig 1). Similarly, no significant difference was evident for patients with advanced-stage tumors who underwent SOND, ESOND, or MRND/RND (3-year NCRs, 91.5% for the SOND group, 84.6% for the ESOND group, 84.2% for the MRND/RND group; P = .320; Fig 2).

Twenty-seven patients (14.2%) in the cN^+ group (SOND, 10 cases; ESOND, 4 cases; MRND/RND, 13 cases) developed nodal recurrence alone. The distribution of neck recurrence was as follows: of the 10

Table 3. DISTRIBUTION OF PATHOLOGICALLY POSITIVE NODES IN CLINICAL N0 AND cN^+ CASES

	cN0 Cases (n = 447)		cN^+ Cases (n = 190)	
Lymph Node Level	n	%	n	%
MRND/RND + ESOND + SOND (n = 637)	447	70.2	190	29.8
I	43	9.6	40	21.1
II	50	11.2	33	17.4
III	4	0.9	4	2.1
I + II	14	3.1	32	16.8
I + III	5	1.1	5	2.6
II + III	2	0.4	9	4.7
I + II + III	3	0.7	9	4.7
MRND/RND + ESOND (n = 312)	190	60.9	122	39.1
IV	—	—	—	—
I + IV	—	—	1	0.8
II + IV	1	0.5	1	0.8
III + IV	1	0.5	—	—
I + II + IV	2	1.0	2	1.6
I + III + IV	—	—	1	0.8
II + III + IV	1	0.5	1	0.8
I + II + III + IV	—	—	1	0.8
MRND/RND (n = 248)	147	59.3	101	40.7
V	—	—	—	—
I + V	—	—	1	1.0
I + II + V	—	—	1	1.0
I + III + V	—	—	1	1.0
II + III + V	—	—	1	1.0
II + IV + V	1	0.7	—	—
I + II + III + V	—	—	1	1.0
I + III + IV + V	—	—	1	1.0
I + II + III + IV + V	—	—	1	1.0

Abbreviations: cN0, clinically negative node; cN^+, clinically positive node; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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Table 4. SITES OF NODAL RECURRENCE IN cN0 GROUP

	SOND Group (n = 19)				ESOND Group (n = 6)				MRND/RND Group (n = 16)			
Nodal Recurrence	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Ipsilateral	4	4	1	5	1	1	0	1	0	4	1	5
Contralateral	1	3	0	0	0	1	0	1	1	2	1	2
Bilateral	0	1	0	0	0	1	0	0	0	0	0	0

Abbreviations: ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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patients in the SOND group, there were 9 ipsilateral recurrences (90.0%) and 1 contralateral recurrence (10.0%); of the 4 patients in the ESOND group, there were 1 ipsilateral recurrence (25.0%) and 3 contralateral recurrences (75.0%); and of the 13 patients in the MRND/RND group, there were 7 ipsilateral recurrences (53.8%) and 6 contralateral recurrences (46.2%). All patients with cN^+ neck were followed for 3 to 18 years, and no nodal recurrence alone at level IV or V was found. The distribution of neck recurrence by tumor stage in the cN^+ group is presented in Table 5. Similar to the cN0 group, there was no significant difference found for patients in the cN^+ group with T1 to T2 disease who received SOND, ESOND, or MRND/RND (3-year NCRs, 91.9% for the SOND group, 88.9% for the ESOND group, 85.4% for the MRND/RND group; $P = .511$; Fig 3). In addition, no significant difference was evident for patients with T3 to T4 tumors who underwent SOND, ESOND, or MRND/RND (3-year NCRs, 83.9% for the SOND group, 75.0% for the ESOND group, 90.0% for the MRND/RND group; $P = .420$; Fig 4).

Overall, salvage therapy was performed in 57 patients with neck recurrence. RNDs were performed in 38 patients, including 10 patients who received postoperative RT and 1 patient who received postoperative concurrent chemoradiotherapy (CCRT). Fourteen patients received salvage RT and 2 patients received salvage CCRT. Conversely, 3 patients received palliative chemotherapy alone. After accounting for potential confounding variables (age, gender, site, pathologic grade, tobacco and alcohol habits, tumor

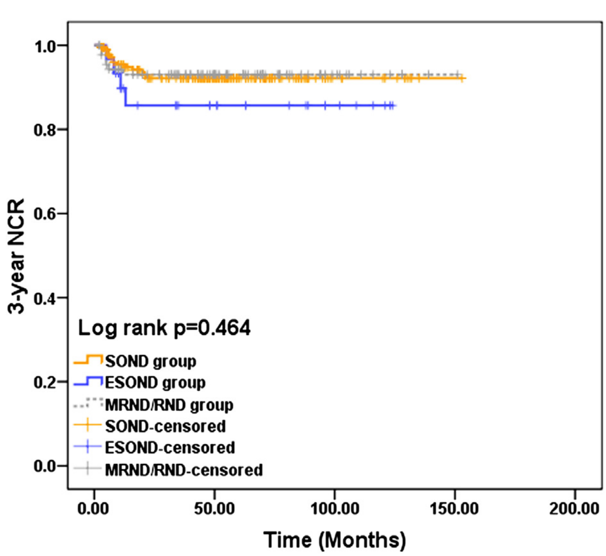

FIGURE 1. Kaplan-Meier survival curves of 3-year NCR for patients with cN0 neck and early-stage disease treated with SOND, ESOND, or MRND/RND. ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; NCR, neck control rate; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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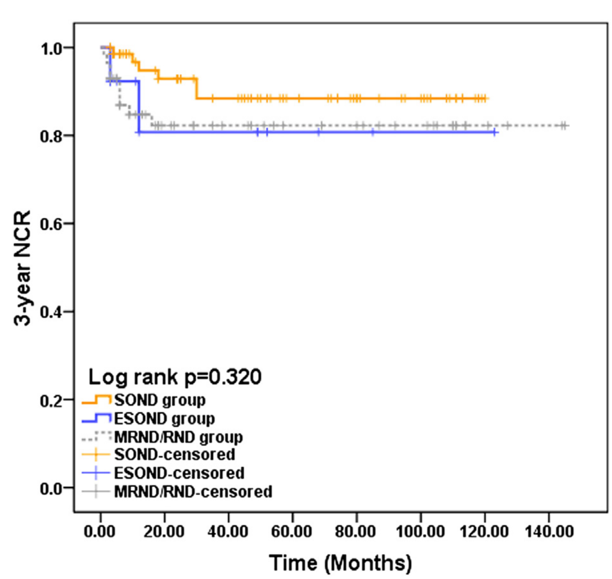

FIGURE 2. Kaplan-Meier survival curves of 3-year NCR for patients with cN0 neck and advanced-stage disease treated with SOND, ESOND, or MRND/RND. ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; NCR, neck control rate; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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Table 5. SITES OF NODAL RECURRENCE IN cN⁺ GROUP

	SOND Group (n = 10)				ESOND Group (n = 4)				MRND/RND Group (n = 13)			
Nodal Recurrence	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Ipsilateral	2	3	1	3	0	1	0	0	0	5	1	1
Contralateral	0	0	1	0	0	0	1	2	1	1	1	3
Bilateral	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations: ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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stage, nodal status, and modalities of neck treatment), a multivariate analysis showed that only nodal status was an independent predictor of NCR (hazard ratio = 1.616; 95% confidence interval [CI], 1.229-2.124; P = .001).

SURVIVAL ANALYSIS OF DIFFERENT MODALITIES OF NECK DISSECTION

During the follow-up period, 255 (40.0%) of the 637 patients died (MRND/RND group, 111 cases; ESOND group, 26 cases; SOND group, 118 cases). Fourteen patients died of causes unrelated to cancer (9 cases in the SOND group and 5 cases in the MRND/RND group). More specifically, 7 patients died of cardiac failure and brain stroke, 3 patients died of respiratory failure, 2 patients died of multiple organ failure, and 2 patients died of unknown causes.

In the cN0 group, a statistically significant difference was observed in the 3-year DSS rates for different tumor stages (T1, 92.9%; T2, 79.8%; T3, 76.8%; T4, 57.6%; $P < .001$). To eliminate the imbalance of tumor distribution in the different subgroups of neck treatment, neck treatment and prognosis in early- and advanced-stage tumors were analyzed further. The 3-year DSS rates for early-stage tumors were not significantly different across the SOND, ESOND, and MRND/RND groups (83.3% vs 80.0% vs 88.9%; P = .380; Fig 5). In addition, the 3-year DSS rates for advanced-stage tumors were not significantly different across treatment groups (71.8% vs 53.8% vs 57.9%; P = .147; Fig 6).

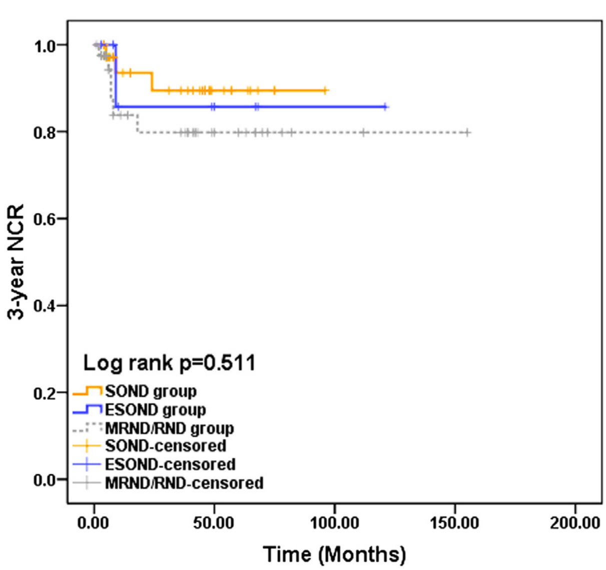

FIGURE 3. Kaplan-Meier survival curves of 3-year NCR for patients with cN⁺ neck and early-stage disease treated with SOND, ESOND, or MRND/RND. ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; NCR, neck control rate; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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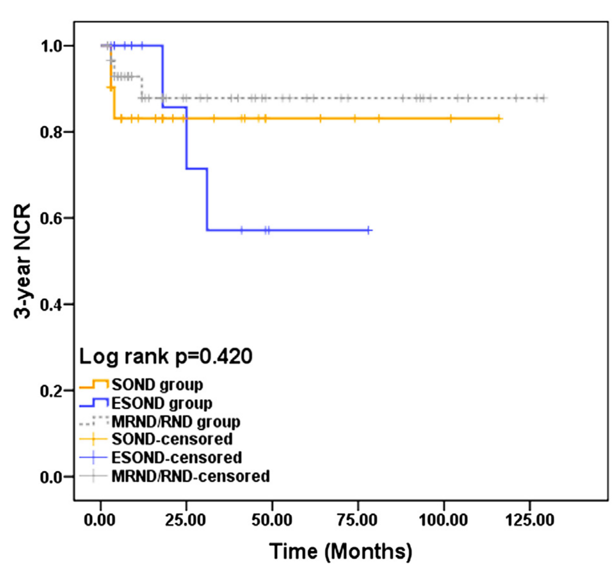

FIGURE 4. Kaplan-Meier survival curves of 3-year NCR for patients with cN⁺ neck and advanced-stage disease treated with SOND, ESOND, or MRND/RND. ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; NCR, neck control rate; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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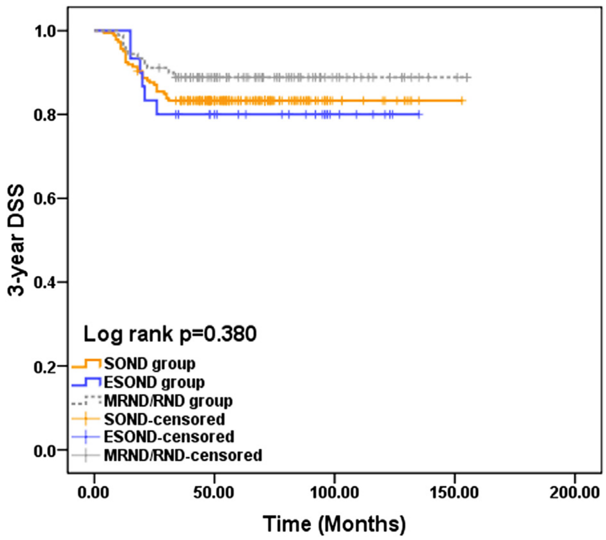

FIGURE 5. Kaplan-Meier survival curves of 3-year DSS for patients with cN0 neck and early-stage disease treated with SOND, ESOND, or MRND/RND. DSS, disease-specific survival; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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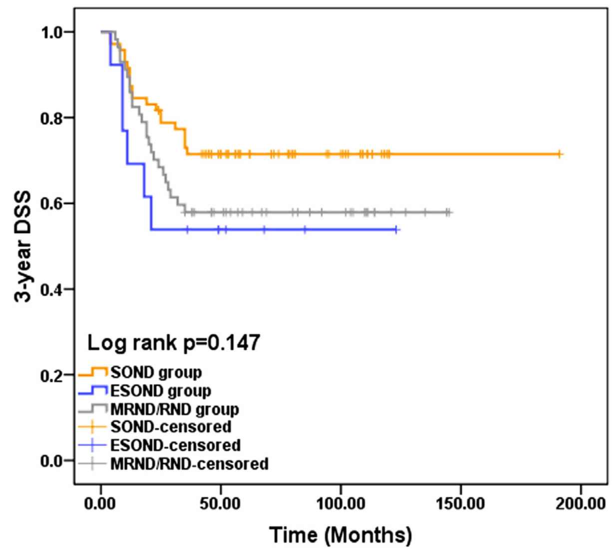

FIGURE 6. Kaplan-Meier survival curves of 3-year DSS for patients with cN0 neck and advanced-stage disease treated with SOND, ESOND, or MRND/RND. DSS, disease-specific survival; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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In the cN^+ group, there was no statistically significant difference in the 3-year DSS rate among tumor stages (T1, T2, T3, and T4 lesions were 60.0%, 63.9%, 54.5%, and 50.6%, respectively; $P = .403$). Further analysis of neck treatments and the 3-year DSS for T1 to T2 stage tumors showed that the prognosis was not significantly different among the SOND, ESOND, and MRND/RND groups (67.6% vs 55.6% vs 61.0%; $P = .785$; Fig 7). Similarly, for T3 to T4 tumors, there was no significant difference among the 3 treatment groups (54.8% vs 58.3% vs 51.7%; $P = .884$; Fig 8).

Multivariate analysis of the entire study cohort showed that tumor stage (hazard ratio = 1.306; 95% CI, 1.155-1.477; $P < .001$), nodal status (hazard ratio = 1.613; 95% CI, 1.370-1.898; $P < .001$), and pathologic grade (hazard ratio = 1.277; 95% CI, 1.026-1.589; $P = .028$) were independent prognostic factors for DSS.

Discussion

Currently, the neck is staged by palpation and different imaging techniques, including ultrasound, computed tomography, magnetic resonance imaging, and more recently positron-emission tomography and computed tomography, which are more accurate than palpation alone.[14,15] However, approximately one third of nodal metastases are smaller than the 3-mm detection sensitivity limit of the currently available imaging techniques.[16] Many studies have shown that elective neck dissection results in better overall survival than does using the observation strategy followed by therapeutic neck dissection.[17-20] However, great controversy remains regarding the best modality for neck dissections in patients with oral cancer.[2,6-8,21]

Crile,[22] with a better understanding of the biological behavior of neck disease, first described RND as a basic

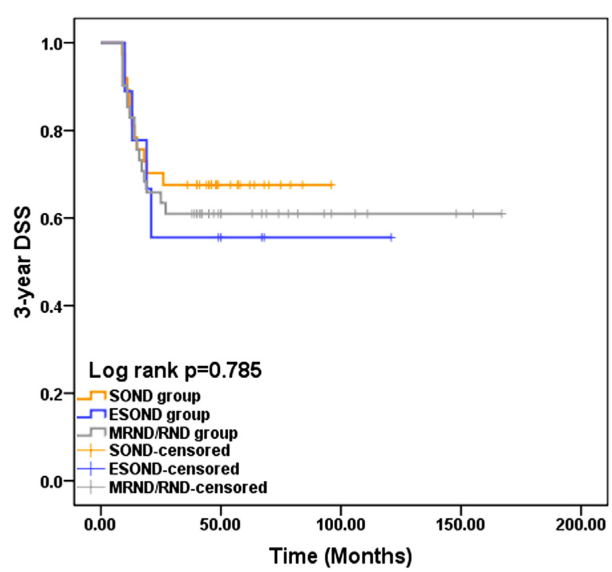

FIGURE 7. Kaplan-Meier survival curves of 3-year DSS for patients with cN^+ neck and early-stage disease treated with SOND, ESOND, or MRND/RND. DSS, disease-specific survival; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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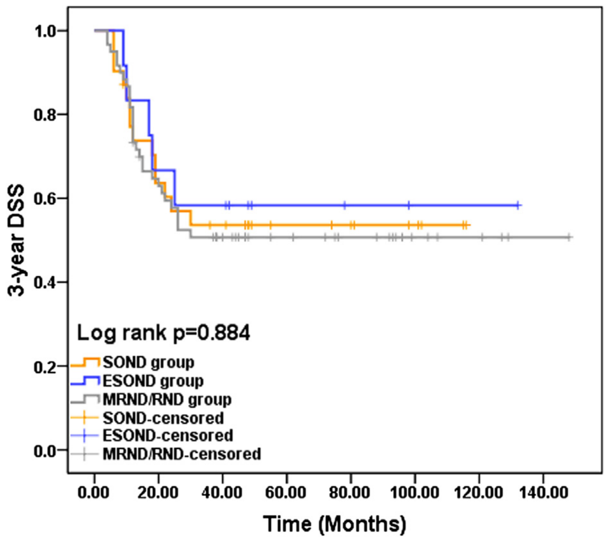

FIGURE 8. Kaplan-Meier survival curves of 3-year DSS for patients with cN^+ neck and advanced-stage disease treated with SOND, ESOND, or MRND/RND. DSS, disease-specific survival; ESOND, extended supraomohyoid neck dissection; MRND, modified radical neck dissection; RND, radical neck dissection; SOND, supraomohyoid neck dissection.

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procedure for neck treatment. Since then, the surgical technique for neck dissections has evolved from RND to MRND and then to SND.[23] The purpose of SND is to selectively remove the lymphatic groups at high risk for metastasis and to decrease morbidity by preserving the sternocleidomastoid muscle, internal jugular vein, and accessory nerve, which are routinely dissected in RND. SOND is a subtype of SND that is used to dissect only high-risk level I, II, or III nodes. SOND has been identified as an appropriate staging procedure to provide valuable cervical pathologic information for patients with OSCC.[24-26] However, the role of SND as a therapeutic procedure, especially when comparing the effectiveness of MRND/RND or ESOND with regard to oncologic outcomes, remains controversial because of the limited amount of available data.

In 1938, the dissertation by Rouviere[27] was the first to describe the anatomy and mechanism of metastasis, which included the lymphatic pathways of tongue cancer draining to a level IV node as the only manifestation of metastatic disease. Byers et al[8] also found that tongue SCC has a 15.8% rate of level IV or III nodal skip metastasis as the only manifestation of the disease. In addition, they believed that the usual SOND was inadequate for evaluating all nodes at risk for metastasis in patients with SCC and recommended ESOND as the preferred method for elective neck dissection.

However, the present results showed that level III lymph nodes were observed in only 9 of the 637 cases (1.4%) without the involvement of level I or II. In addition, skip metastasis was found at level IV in only 1 case and actually was coupled with skip metastasis at level III lymph nodes. Interestingly, in another study, cytokeratin staining of semi-serial sections showed that pathologic skip metastasis at level IV might actually be coupled with nodal micrometastasis at levels I to III, which is recognized as actual N2b disease. This conclusion suggests that actual skip metastasis in oral cancer is very rare and controversial.[28] However, it is an almost impossible task for pathologists to perform a semi-serial section analysis of every case to exclude skip metastasis. Therefore, the actual rate of skip metastasis is likely lower than the rates previously reported.

In this study, the survival analysis in the cN0 group showed that SOND had a similar survival rate as MRND/RND or ESOND. The rare skip metastasis at level IV indicates that ESOND is not essential. Therefore, the authors recommended SOND as the preferred choice for neck treatment in patients with cN0 neck and OSCC. In the cN^+ group, skip metastasis at level III and IV lymph nodes was similarly as low as in the cN0 group. In addition, survival analysis in the cN^+ group showed that SOND did not differ significantly from MRND/RND or ESOND. SOND also may be an acceptable alternative to the MRND/RND or ESOND for patients with cN^+ neck disease.

In the univariate analysis of 3-year DSS, the modalities of neck treatment were irrelevant to the prognosis of patients with OSCC and cN0 or cN^+ neck. In addition, in multivariate analysis of the entire study cohort, the results showed that tumor stage, nodal status, and pathologic grade were the only independent prognostic factors for DSS. Also, the modalities of neck treatment cannot serve as the independent predictor for DSS. Therefore, SOND may be the most ideal choice for neck management of patients with OSCC because of fewer wounds and complications.

Although many subsites and different tumor stages of primary tumors were pooled together in this study, the authors believe the conclusion is reliable because all baseline factors were well matched among the different groups. The study is retrospective, so all conclusions are exploratory. Further prospective studies on these issues are in progress by the authors. It is worth anticipating that the final conclusions will be reported to clarify these controversies.

Overall, skip metastases in OSCC at levels IV and V are very rare and very difficult to evaluate definitively. For patients with cN0 and even cN^+ neck tumors, SOND may be an acceptable alternative to ESOND and MRND/RND, but the final conclusions still need to be drawn through a randomized controlled trial.

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