Cervical Metastases Behavior of T1–2 Squamous Cell Carcinoma of the Tongue

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Abstract

Introduction The cervical lymph node metastasis (CM) is one of the most important prognostic factors for oral squamous cell carcinoma. Although the frequency and distribution of CM for tongue carcinoma (TC) are well documented in the literature, there is only little data on metastasis patterns depending on the location of the cancer within the tongue.

Materials and Methods In a retrospective study all patients with a T1–T2 TC who were treated between 1997 and 2013 were analysed regarding epidemiological data, risk factors, and tumour parameters such as exact localization, CM.

Results 204 patients (59 ± 15 years; ♀37 %, ♂63 %) were included. At the initial diagnosis 23 % had an advanced tumour stage (III–IV) due to CM. The occurrence of CM was significantly higher for T2, advanced G-status and the localization in the posterior area of the tongue. The presence of CM—but not the recurrence—had a significant influence on the survival rate.

Conclusion The small TC has an aggressive metastatic behaviour depending not only on the classical prognostic factors such as grading and tumour size, but is also strongly influenced by the posterior location within the tongue.

Keywords Oral cancer · Head and neck cancer · Squamous cell carcinoma of the tongue · Lymphatic metastasis

Introduction

With 200,000–350,000 cancer deaths per year worldwide the oral squamous cell carcinoma (OSCC) is ranked sixth in the list of the most common malignant tumours [1, 2]. The most important clinical prognosis factors at the time of initial diagnosis are the tumour size and the presence of lymph node metastasis in the neck [3, 4]. The cervical metastases (CM) most often occur in levels I and II [5, 6]. There is a high incidence of occult cervical lymph node metastases of approximately 25 % in a clinical negative neck (cN0) case situation resulting in diagnostic and therapeutic difficulties [7–9]. Strategies how to deal with the cN0 still remain controversial and reach from a wait and see strategy to a prophylactic neck dissection. Clinical characteristics of the tumour and histopathological features can help to adjust the estimated risk of CM [9, 10]. Although factual data for metastasis of OSCC and specially for the tongue and the benefits of prophylactic neck dissection have been published [3, 11–13], there are only few studies concerning the behaviour of CM according to the location of the TC itself for small cancers [14, 15].

Materials and Methods

All patients with SCC of the tongue (TC) who were treated from 1997 to 2013 at the Department of Oral and Maxillofacial Surgery of the University Medical Center in Mainz, Germany were comprised. All clinical data files

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from the tumour patients were scanned for primary TC. The exclusion criteria were malignancies other than OSCC, malignancies that were not primarily treated in domo, tumours from other locations that secondarily infiltrated the tongue and tumours that infiltrated other parts of the oral cavity but not the tongue. All patients underwent a surgical therapy of the tongue cancer including tumour resection and at least a selective neck dissection of the ipsilateral site in level I–III. Due to the fact that a skip metastases is very rare in T1/2 tongue cancer [16, 17] we only performed a lymph node dissection in levels I–III and only extended it to levels IV–V when a CM was detected in the higher levels. 85 % (n = 174) of the patients underwent a primary bilateral neck dissection. Intraoperatively frozen sections were performed to detect possible CM with immediate extension of the ND in Levels IV and V. And in case of later detection in the final histopathological specimen a revision surgery in levels IV and V were performed.

The following data were collected: epidemiological information (age, gender, time of diagnosis), main risk factors (alcohol and tobacco), localization and site of the tumour within the tongue (front, middle and posterior third), tumour size, lymph node and distant metastasis status, histologic resection margin, grading, follow-up time, recurrence, and survival. The TC was classified according to the 2003 TNMG staging system of the UICC [18].

Statistical analysis was performed using *SPSS 17.0 for Windows®*. The survival rate and the statistic calculation were processed using a Kaplan–Meier plot in combination with a log-rank test. The analysis of the tumour localization was evaluated by a Chi square test. The relationship between cervical metastasis and clinical factors such as the TNM stage of the tumour and the location of the tumour were analysed with a logistic regression. A *p* value of ≤ 0.05 was defined as statistically significant.

Results

Epidemiological Data, Risk Factors and Distribution Within the Tongue

In the analysed period a total of 283 patients suffered from a tumour that was only located in the tongue. In 35 cases the TC was not a primary tumour and in an additional five patients a carcinoma in situ was diagnosed. Of the remaining 243 patients with a primary OSCC of the tongue 204 patients had a T1 or T2 tumour and were comprised for further analysis. The average age of this patient group was of 59 ± 15 years (standard deviation). Seventy-six patients (37 %) were females (age 61 ± 16 years) and 128 patients (63 %) were males (age 58 ± 14 years). The average follow-up time was 48 months (range 1–214). 60 % of the

patients showed a risk profile regarding smoking (smokers 41 %) and frequent consumption of alcohol (patients drinking alcohol 51 %). The rate for the risk factors was higher for male patients (66 %) compared to female patients (50 %). 52 % of the TC were located on the right, 48 % on the left hand side, 25 % in the anterior third of the tongue, 50 % in the middle third, and 25 % in the posterior third (Table 1).

TNM-Status and Cervical Lymphatic Metastasis

23 % of the patients had an advanced tumour stage (3–4) due to a CM at the time of the initial diagnosis. In two cases the CM was on the contralateral site. The rate of occult CM was 10 % (17 pN+ cases were preoperative cN0). No patient showed a distant metastasis at the initial presentation. The majority of patients had a G2–3 tumour differentiation. 21 % of the OSCC had a good differentiation (G1) (Table 1). Out of 126 T1 tumours 35 were in the anterior, 63 in the middle and 28 in the posterior third. Fifteen out of 78 T2 tumours were in the anterior, 39 in the middle and 24 in the posterior third, so that T1 and T2 tumours were more or less evenly spread throughout the tongue ($p = 0.245$).

To identify which of the following parameters—tumour size, differentiation or localization of the tumour—may influence the rate of CM a logistic regression was performed

Table 1 Epidemiological data and TNM classification of the patients with T1–T2 SCC of the tongue at the point of initial diagnosis

Female (n = 76)	37 %
Male (n = 128)	63 %
Positive risk profile (n = 123)	60 %
Negative risk profile (n = 81)	40 %
Localisation right site (n = 106)	52 %
Localisation left site (n = 98)	48 %
Localisation anterior (n = 50)	25 %
Localisation middle (n = 102)	50 %
Localisation posterior (n = 52)	25 %
T1 (n = 126)	62 %
T2 (n = 78)	38 %
N0 (n = 157)	77 %
N1 (n = 27)	13 %
N2b (n = 18)	9 %
N2c (n = 2)	1 %
M0 (n = 204)	100 %
G1 (n = 42)	21 %
G2 (n = 139)	68 %
G3 (n = 23)	11 %

Risk profile refers to a positive anamnesis for smoking and alcohol consumption. 23 % of the patients (n = 47) had at least one lymph node metastasis

Table 2 Presence of CM according to the tumour size, grading and localization at the point of initial diagnosis

T-/G-stage localisation	N0	N+	Portion of N+ to the respective T/G-stage and localisation (%)	<i>p</i>
T1 (n = 126)	108	18	14	0.006
T2 (n = 78)	49	29	37	
G1 (n = 42)	40	2	5	
G2 (n = 139)	107	32	23	<0.001
G3 (n = 23)	10	13	57	
Anterior third (n = 50)	45	5	10	
Middle third (n = 102)	81	21	21	0.002
Posterior third (n = 52)	31	21	40	

to detect confounding parameters. Both the tumour size ($p = 0.006$) and the differentiation ($p < 0.001$) of the tumour were significantly associated with an increased risk for the occurrence of CM. Only 14 % of T1 carcinomas in comparison to 37 % of T2 carcinomas showed a CM (Table 2). 57 % of G3 carcinomas and 23 % of the G2 carcinomas already had a CM whereas only 5 % of good differentiated (G1) carcinomas had one (Table 2). Furthermore the localization of the tumour in the posterior region of the tongue (middle and posterior third) significantly increased the risk for a CM ($p = 0.002$). 40 % of the posterior TCs already had developed a CM, whereas only 21 % of the middle part and 10 % of the anterior third showed a locoregional spread (Table 2).

The average follow-up period was 48 months. Overall, 26 % of the patients developed a recurrence after 12 months (median). The majority of the patients developed a CM (40 %) or local recurrence (35 %). The neck recurrence was ipsilateral in 76 % ($n = 16$) and contralateral 24 % ($n = 5$) of cases. Distant metastases with 9 % and a second OSCC in a different localization with 16 % were rarer causes of relapse.

For the T1 and T2 tongue carcinomas the presence of lymph node metastases had a significant effect on the 10-year survival ($p = 0.02^*$) (Fig. 1). The recurrence had no significant effect on survival ($p = 0.31^*$) (Fig. 2). Recurrence in our analysis was defined as CM, local recurrence or distant metastases. The recurrence in Fig. 2 was analyzed as one group and was not divided into different subgroups. A second OSCC in a different localization is no recurrence and was therefore excluded from the analysis.

Discussion

Regarding the demographic data and the risk profile our patient pool coincides with the literature (Table 3). The gender distribution of approximately 1:2 (♀:♂) and the average age of 59 ± 15 years are identical to the literature.

Fig. 1 Overall survival for TC patients based on the presence or absence of CM **Fig. 2** Overall survival for TC patients based on the presence or absence of relapse

The high proportion of 60 % of the patients with a history of typical risk factors (tobacco and alcohol) and the higher proportion of men among them agrees well with the published data [19, 20].

Despite advances in multimodal therapy, the 5-year survival rate for OSCC has not improved significantly over the last decades. It remains at 50–55 % with a wide

Table 3 Published CM rates for T1–T2 tongue cancer. Some studies had other tumour locations included beside the tongue

References	Country	No. of patients with T1/T2 TC	Portion of male patients (%)	Average age (years)	Grading 2–3 (%)	Initial N+ disease (%)
Pimenta Amaral et al. [33]	Brazil	193 (117)	75	58	37	23
Keski-Säntti et al. [32]	Finland	73	49	59	67	32
O-charoenrat et al. [34]	UK	50	62	60	94	40
Kurokawa et al. [35]	Japan	50	54	55	36	14
Sparano et al. [31]	USA	45	62	55	16	29
Yuen et al. [36]	China	85	62	59	44	35
Vishak et al. [37]	India	57	75	45	61	27
Mücke et al. [38]	Germany	327	68	61	88	19
Iype et al. [39]	India	219 (158)	60	57	44	26
Current study	Germany	204	63	59	79	23

For these studies, the number of patients with TC is given in parentheses

spectrum from 20 to over 80 % depending on the tumour stage [14, 21]. The TNM classification is a reliable indicator of prognosis for the OSCC with primary tumour size and cervical metastasis status being the most significant factors affecting the survival [22]. The estimation of tumour size in the OSCC is certainly possible by clinical examination and modern imaging methods. Unfortunately, the preoperative diagnosis provides no reliable information for the evaluation of cervical lymph nodes [23]. Because of the high rate of occult metastases in particular in tongue cancer the neck dissection continues to be the gold standard for the assessment of the lymph node status and is therefore anchored in guidelines [14, 24]. In prospective randomized studies, the benefit of selective neck dissection (SND) compared to wait and see strategies for early stage OSCC with a clinically N0 situation has been proven [25, 26]. About 30 % of patients with OSCC are found to have lymph node metastasis on their initial evaluation, with an even higher rate in patients with oral tongue cancer due to its anatomy with a dense lymphatic network [14]. There is also the fact that micrometastatic tumor deposits can easily be missed in routine histopathological examination, consequently resulting in underestimation of the real occult metastasis rate [27]. The incidence rate of micrometastasis with clinically N0 necks is reported to be between 9 and 22 % [28] and their presence is associated with a negative outcome for the patients [29]. The histopathological examination of the lymph nodes of this study did not include immunohistochemical staining. Therefore the real rate of occult CM might be higher than the 10 % detected by the routine histopathological examination.

Nevertheless conversely, a majority of patients is over treated by the neck dissection. To reduce the possible postoperative complication, therefore, on the one hand modification of ND with preservation of anatomical structures and selection of the relevant lymph node level

has been made [30]. On the other hand through the establishment of risk scores with the help of clinical and histopathological risk characteristics (size, differentiation, depth of tumour infiltration, tumour thickness, invasion front, etc.) it is possible to estimate the risk for the development of CM in a better way [31]. However, for the most histopathological risk factors a reliable estimation is only possible after the evaluation of the whole tumour block [23, 32]. Thus localization, tumour size and differentiation remain as simple and practicable risk factors for preoperative risk stratification.

Even for the small T1–2 OSCC the N-status is an important prognostic factor for the survival. The development of a recurrence leads to a worsening of the survival curve, which however is not significant in the present analysis. The effect of potential salvage treatment has not been analysed. The recurrence remains a significant influence factor for survival when considering the distant metastases isolated from the loco-regional recurrence (CM and local recurrence). Critical to the evaluation of the survival curves is the relatively high proportion of patients with a short follow-up time of less than 6 months. In the analyzed data 12 % of the patients (n = 25) had a follow-up less than 6 months and therefore were excluded from the survival analysis. Furthermore the depth of invasion is a risk parameter for the development of cervical metastasis [12, 14]. But it was not analyzed due to retrospective nature of this epidemiologic study. The specimens have not been analyzed again.

Conclusion

The proportion of 23 % of T1–T2 TC with CM was rather high as described in literature. Next to the classic risk factors for CM like tumour size and poor differentiation

this study identified the localization of the TC to be another risk factor with a higher risk for TC in the posterior portion of the tongue. Even for the small tongue carcinomas the presence of a lymphatic metastasis significantly influenced the survival. The SND should be performed in small tumour, however if a wait and see strategy is being discussed then in addition to the tumour size and grading the location should be taken into consideration for decision making.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Standard A retrospective study was performed without any further consequences for the patient. According to this and the hospital laws of the individual states (*Krankenhauslandesgesetz*) no approval by the local ethics committee is necessary. The study was not sponsored.

References

- Argiris A, Karamouzis MV, Raben D, Ferris RL (2008) Head and neck cancer. *Lancet* 371(9625):1695–1709. doi:[10.1016/S0140-6736\(08\)60728-X](https://doi.org/10.1016/S0140-6736(08)60728-X)
- Jemal A, Siegel R, Ward E, Hao Y, Xu J, Murray T et al (2008) Cancer statistics, 2008. *CA Cancer J Clin* 58(2):71–96. doi:[10.3322/CA.2007.0010](https://doi.org/10.3322/CA.2007.0010)
- Capote A, Escorial V, Munoz-Guerra MF, Rodriguez-Campo FJ, Gamallo C, Naval L (2007) Elective neck dissection in early-stage oral squamous cell carcinoma—does it influence recurrence and survival? *Head Neck* 29(1):3–11. doi:[10.1002/hed.20482](https://doi.org/10.1002/hed.20482)
- Hiratsuka H, Miyakawa A, Nakamori K, Kido Y, Sunakawa H, Kohama G (1997) Multivariate analysis of occult lymph node metastasis as a prognostic indicator for patients with squamous cell carcinoma of the oral cavity. *Cancer* 80(3):351–356
- Kowalski LP, Bagietto R, Lara JR, Santos RL, Tagawa EK, Santos IR (1999) Factors influencing contralateral lymph node metastasis from oral carcinoma. *Head Neck* 21(2):104–110
- Woolgar JA (2007) The topography of cervical lymph node metastases revisited: the histological findings in 526 sides of neck dissection from 439 previously untreated patients. *Int J Oral Maxillofac Surg* 36(3):219–225. doi:[10.1016/j.ijom.2006.10.014](https://doi.org/10.1016/j.ijom.2006.10.014)
- Mishra P, Sharma AK (2010) A 3-year study of supraomohyoid neck dissection and modified radical neck dissection type I in oral cancer: with special reference to involvement of level IV node metastasis. *Eur Arch Otorhinolaryngol* 267(6):933–938. doi:[10.1007/s00405-009-1155-9](https://doi.org/10.1007/s00405-009-1155-9)
- Yuen AP, Ho CM, Chow TL, Tang LC, Cheung WY, Ng RW et al (2009) Prospective randomized study of selective neck dissection versus observation for N0 neck of early tongue carcinoma. *Head Neck* 31(6):765–772. doi:[10.1002/hed.21033](https://doi.org/10.1002/hed.21033)
- Monroe MM, Gross ND (2012) Evidence-based practice: management of the clinical node-negative neck in early-stage oral cavity squamous cell carcinoma. *Otolaryngol Clin N Am* 45(5):1181–1193. doi:[10.1016/j.otc.2012.06.016](https://doi.org/10.1016/j.otc.2012.06.016)
- Sagheb K, Sagheb K, Taylor KJ, Al-Nawas B, Walter C (2014) Cervical metastases of squamous cell carcinoma of the maxilla: a retrospective study of 25 years. *Clin Oral Invest* 18(4):1221–1227. doi:[10.1007/s00784-013-1070-8](https://doi.org/10.1007/s00784-013-1070-8)
- Chiu RJ, Myers EN, Johnson JT (2004) Efficacy of routine bilateral neck dissection in the management of supraglottic cancer. *Otolaryngol–Head Neck Surg* 131(4):485–488. doi:[10.1016/j.otohns.2004.04.024](https://doi.org/10.1016/j.otohns.2004.04.024)
- Feng Z, Li JN, Li CZ, Guo CB (2014) Elective neck dissection versus observation in the management of early tongue carcinoma with clinically node-negative neck: a retrospective study of 229 cases. *J Craniomaxillofac Surg* 42(6):806–810. doi:[10.1016/j.jcms.2013.11.016](https://doi.org/10.1016/j.jcms.2013.11.016)
- Haddadin KJ, Soutar DS, Oliver RJ, Webster MH, Robertson AG, MacDonald DG (1999) Improved survival for patients with clinically T1/T2, N0 tongue tumors undergoing a prophylactic neck dissection. *Head Neck* 21(6):517–525
- Sano D, Myers JN (2007) Metastasis of squamous cell carcinoma of the oral tongue. *Cancer Metastasis Rev* 26(3–4):645–662. doi:[10.1007/s10555-007-9082-y](https://doi.org/10.1007/s10555-007-9082-y)
- Shear M, Hawkins DM, Farr HW (1976) The prediction of lymph node metastases from oral squamous carcinoma. *Cancer* 37(4):1901–1907
- Luan XW, Mao C, Yu GY, Guo CB, Huang MX, Ma DQ (2006) Analysis on occult micrometastasis in levels III–IV of cN0 neck in patients with oral tongue squamous cell carcinoma. *Hua Xi Kou Qiang Yi Xue Za Zhi* 24(2):128–130
- Dias FL, Lima RA, Kligerman J, Farias TP, Soares JR, Manfro G et al (2006) Relevance of skip metastases for squamous cell carcinoma of the oral tongue and the floor of the mouth. *Otolaryngol–Head Neck Surg* 134(3):460–465. doi:[10.1016/j.otohns.2005.09.025](https://doi.org/10.1016/j.otohns.2005.09.025)
- Rivera C (2015) Essentials of oral cancer. *Int J Clin Exp Pathol* 8(9):11884–11894
- Johnson NW (2001) Aetiology and risk factors for oral cancer, with special reference to tobacco and alcohol use. *Magy Onkol* 45(2):115–122
- Petti S (2009) Lifestyle risk factors for oral cancer. *Oral Oncol* 45(4–5):340–350. doi:[10.1016/j.oraloncology.2008.05.018](https://doi.org/10.1016/j.oraloncology.2008.05.018)
- Rusthoven KE, Raben D, Song JJ, Kane M, Altoos TA, Chen C (2010) Survival and patterns of relapse in patients with oral tongue cancer. *J Oral Maxillofac Surg* 68(3):584–589. doi:[10.1016/j.joms.2009.03.056](https://doi.org/10.1016/j.joms.2009.03.056)
- Kadmani D, Bell RB, Bagheri S, Holmgren E, Dierks E, Potter B et al (2005) Prognostic factors in intraoral squamous cell carcinoma: the influence of histologic grade. *J Oral Maxillofac Surg* 63(11):1599–1605. doi:[10.1016/j.joms.2005.07.011](https://doi.org/10.1016/j.joms.2005.07.011)
- Kowalski LP, Sanabria A (2007) Elective neck dissection in oral carcinoma: a critical review of the evidence. *Acta otorhinolaryngologica Italica: organo ufficiale della Societa italiana di otorinolaringologia e chirurgia cervico-facciale* 27(3):113–117
- Wolff KD, Follmann M, Nast A (2012) The diagnosis and treatment of oral cavity cancer. *Deutsch Archzteblatt Int* 109(48):829–835. doi:[10.3238/arztebl.2012.0829](https://doi.org/10.3238/arztebl.2012.0829)
- Ren ZH, Xu JL, Li B, Fan TF, Ji T, Zhang CP (2015) Elective versus therapeutic neck dissection in node-negative oral cancer: evidence from five randomized controlled trials. *Oral Oncol* 51(11):976–981. doi:[10.1016/j.oraloncology.2015.08.009](https://doi.org/10.1016/j.oraloncology.2015.08.009)
- D'Cruz AK, Vaish R, Kapre N, Dandekar M, Gupta S, Hawaldar R et al (2015) Elective versus therapeutic neck dissection in node-negative oral cancer. *N Engl J Med* 373(6):521–529. doi:[10.1056/NEJMoa1506007](https://doi.org/10.1056/NEJMoa1506007)
- van den Brekel MW, van der Waal I, Meijer CJ, Freeman JL, Castelijns JA, Snow GB (1996) The incidence of micrometastases in neck dissection specimens obtained from elective neck dissections. *Laryngoscope* 106(8):987–991
- Ferlito A, Shaha AR, Rinaldo A (2002) The incidence of lymph node micrometastases in patients pathologically staged N0 in cancer of oral cavity and oropharynx. *Oral Oncol* 38(1):3–5

29. Cho JH, Lee YS, Sun DI, Kim MS, Cho KJ, Nam IC et al (2015) Prognostic impact of lymph node micrometastasis in oral and oropharyngeal squamous cell carcinomas. *Head Neck*. doi:[10.1002/hed.24314](https://doi.org/10.1002/hed.24314)
30. Hamoir M, Schmitz S, Gregoire V (2014) The role of neck dissection in squamous cell carcinoma of the head and neck. *Curr Treat Options Oncol* 15(4):611–624. doi:[10.1007/s11864-014-0311-7](https://doi.org/10.1007/s11864-014-0311-7)
31. Sparano A, Weinstein G, Chalian A, Yodul M, Weber R (2004) Multivariate predictors of occult neck metastasis in early oral tongue cancer. *Otolaryngol—Head Neck Surg* 131(4):472–476. doi:[10.1016/j.otohns.2004.04.008](https://doi.org/10.1016/j.otohns.2004.04.008)
32. Keski-Santti H, Atula T, Tikka J, Hollmen J, Makitie AA, Leivo I (2007) Predictive value of histopathologic parameters in early squamous cell carcinoma of oral tongue. *Oral Oncol* 43(10):1007–1013. doi:[10.1016/j.oraloncology.2006.11.015](https://doi.org/10.1016/j.oraloncology.2006.11.015)
33. Pimenta Amaral TM, Da Silva Freire AR, Carvalho AL, Pinto CA, Kowalski LP (2004) Predictive factors of occult metastasis and prognosis of clinical stages I and II squamous cell carcinoma of the tongue and floor of the mouth. *Oral Oncol* 40(8):780–786. doi:[10.1016/j.oraloncology.2003.10.009](https://doi.org/10.1016/j.oraloncology.2003.10.009)
34. Oc P, Pillai G, Patel S, Fisher C, Archer D, Eccles S et al (2003) Tumour thickness predicts cervical nodal metastases and survival in early oral tongue cancer. *Oral Oncol* 39(4):386–390
35. Kurokawa H, Yamashita Y, Takeda S, Zhang M, Fukuyama H, Takahashi T (2002) Risk factors for late cervical lymph node metastases in patients with stage I or II carcinoma of the tongue. *Head Neck* 24(8):731–736. doi:[10.1002/hed.10130](https://doi.org/10.1002/hed.10130)
36. Yuen AP, Lam KY, Wei WI, Lam KY, Ho CM, Chow TL et al (2000) A comparison of the prognostic significance of tumor diameter, length, width, thickness, area, volume, and clinico-pathological features of oral tongue carcinoma. *Am J Surg* 180(2):139–143
37. Vishak S, Rohan V (2014) Cervical node metastasis in T1 squamous cell carcinoma of oral tongue-pattern and the predictive factors. *Indian J Surg Oncol* 5(2):104–108. doi:[10.1007/s13193-014-0301-z](https://doi.org/10.1007/s13193-014-0301-z)
38. Mucke T, Mitchell DA, Wagenpfeil S, Ritschl LM, Wolff KD, Kanatas A (2014) Incidence and outcome for patients with occult lymph node involvement in T1 and T2 oral squamous cell carcinoma: a prospective study. *BMC Cancer* 14:346. doi:[10.1186/1471-2407-14-346](https://doi.org/10.1186/1471-2407-14-346)
39. Iype EM, Sebastian P, Mathew A, Balagopal PG, Varghese BT, Thomas S (2008) The role of selective neck dissection (I–III) in the treatment of node negative (N0) neck in oral cancer. *Oral Oncol* 44(12):1134–1138. doi:[10.1016/j.oraloncology.2008.02.017](https://doi.org/10.1016/j.oraloncology.2008.02.017)