Surgical resection of oral cancer: en-bloc versus discontinuous approach

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Abstract

Objectives In the past literature agreed on treating oral carcinomas, using an "en-bloc" resection (EBR) but recently minimally invasive transoral surgery has spread as the preferable treatment for selected cases. This latter technique, which is performed with a discontinuous resection (DR), allows for a satisfactory postoperative quality of life (QoL) maintaining good survival rates.

Materials and methods In this study, we analyzed data about 147 surgically treated patients with oral cancer involving tongue and floor of the mouth. The sample was divided according to the surgical approach: EBR and DR group which were compared in terms of recurrence, overall survival, disease-free survival, and QoL.

Results In the DR group, survival analysis showed better results in term of survival, locoregional control, and postoperative anxiety, while the other QoL scores were similar in the two groups.

Conclusion The more invasive approach does not correlate to a better outcome. In selected cases, DR is an oncologically safe technique; EBR is still a valid option to treat advanced oral cancers

Keywords T–N tract · Oral cancer · Neck dissection · Transoral surgery · Compartmental surgery

Introduction

Oral cavity represents the main localization of onset of head-and-neck cancer, particularly squamous cell carcinomas, with a worldwide estimated incidence of 275,000 new cases every year [1, 2]. Oral squamous cell carcinomas (OSCC) are characterized by a poor prognosis and a low overall survival (OS) with a 5-year survival rate in most developed countries around 50% [2]. Surgery has long been the most well-established and accepted approach for the treatment of most OSCC; however, despite sophisticated treatment modalities, the survival of patients with OSCC has not largely improved over last decades [3].

The unchanging poor prognosis of oral cancer raises the doubt that some decision-making processes may be incomplete and should be changed to improve survival rates.

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The factors that mainly impact to the prognosis are the tumor diameter and thickness, positive or close margins, and perineural-lymphovascular invasion [4–6].

In our experience, the factors that significantly influenced survival in patients surgically treated for oral cancer were the surgical approach, the neck stage, and the depth of invasion (DOI) [7].

A recent study investigating the surgical treatment of tongue cancer reported that patients who underwent compartmental surgery, which necessarily includes an *en-bloc* approach with tumor, cervical lymph nodes, and tumor-neck tract (T-N tract) resections regardless of T stage, had a better prognosis in terms of OS but no improvement in locoregional control (LRC) [8].

The T–N tract is defined as the fibro-fatty glandular–stromal connection including the sublingual gland, the neurovascular pedicle, and the stromal-lymphatic tissues joining the oral tumor to the cervical lymph nodes [8].

On the other hand, in our experience, patients who underwent conservative transoral surgery had a better prognosis in terms of disease-specific survival (DSS) compared with patients who underwent *en-bloc* approach [7].

This study aimed to compare patients treated with an *en-bloc* resection (EBR), in which the primary tumor and the cervical lymph nodes are removed in continuity, with a discontinuous resection (DR), in which tumor resection and neck dissection are performed using a transoral and a cervical access, respectively. The latter method preserves the anatomical separation between the oral cavity and the neck, limiting postoperative complications, ensuring an acceptable quality of life (QoL), and often avoiding the need to harvest a free flap to reconstruct the floor of the mouth.

The purpose of the present study was to investigate whether the more invasive EBR with removal of the T–N tract could influence Qol and survival: OS, DSS, and disease-free survival (DFS).

To date, it has not yet been demonstrated that the EBR is the gold standard approach to treat oral cancer; on the other hand, the international guidelines recommend to perform in-continuity neck dissection only when there is direct extension of the primary tumor into the neck, unlike compartmental surgery, which is performed regardless of the T stage [9].

Materials and methods

In this retrospective cohort study, we collected data about 165 patients affected by OSCC involving primarily the tongue and floor of the mouth or arising from other oral cavity subsites and spreading to the tongue and/or floor of the mouth, who underwent resection of the primary tumor and neck dissection during the same surgical session. We also included OSCC involving floor of the mouth extended to the oropharynx.

The surgeries were carried out by the same medical team from January 2006 to June 2014 at the Otolaryngology Department of Cattinara Hospital (University of Trieste, Italy). Data were collected up to 2014 so as to have a follow-up/survival time of at least 5 years. Patients were informed about the purpose of the study and gave their consent for the anonymous use of their data.

Exclusion criteria were neoadjuvant radiotherapy as first-choice treatment (cN3), histological type other than OSCC, advanced stage regarded as unresectable disease or unfitness for surgery according to the most recent international guidelines, and previous head-and-neck cancers.

Surgical protocol

The choice of treatment was based on the National Comprehensive Cancer Network (NCCN) guidelines [9]. An EBR, in which the primary tumor and cervical nodes are resected in continuity, was indicated in the case of direct extension of the primary tumor into the neck, mylohyoid muscle invasion or when a segmental mandibulectomy was required. In other cases, a DR was preferred, in which tumor resection and neck dissection are performed at the same time using a transoral access and a cervical access, respectively.

The whole sample underwent neck dissection during the same surgical session, including selective, modified, and radical neck dissection, depending on cN stage.

The adjuvant therapy was performed in the presence of adverse risk features: extranodal extension, positive margins, more than two nodes involved, and advanced primary tumor (pT3 and pT4).

Follow-up

Oncological follow-up visits were scheduled in accordance with the NCCN guidelines: monthly during the first year, bimonthly during the second year, and every 4–6 months from the third to the fifth year after surgery. Data regarding recurrence or metastasis were extracted from the follow-up medical reports and the cause of death was identified by checking the post-mortem reports.

Data collection

The survival rates of patients treated with an EBR versus a DR were compared in relation to the following independent variables:

1. Patient-related: Sex and age of the patient. Because age was considered a binary variable, we divided the sample into two groups with the cut-off point set at 65 years.
2. Tumor-related: The site and stage of the tumor. T and N categories were considered using the seventh and the eighth edition of the American Joint Committee on Cancer (AJCC) staging system (1.2019 version). T1 and T2 tumors were classified as the initial stage and T3 and T4 as advanced stage. Similarly, the N category was divided into negative (N0) or positive (N+). The histopathology reports were reviewed to collect tumor dimension and DOI, number of involved nodes and extracapsular spread, and margin status. In the case of missing DOI data, a dedicated pathologist was consulted to re-evaluate the specimens. Tumor grading was categorized into two groups to be considered a binary variable: early grade G1–2 and advanced grade G3–4.
3. Treatment-related: the surgical approach and neck dissection, the use of microvascular flaps, and adjuvant radiotherapy, if any. The surgical approach was considered a binary variable, and we distinguished between a more conservative approach (DR group) and a more invasive approach (EBR group).

Finally, to evaluate quality of life (QoL), each oncological patient in our department routinely completes the University

of Washington QoL Questionnaire version 4, 6 months after surgery [10].

The questionnaire comprises 12 single-question items, which have between 3 and 6 possible responses scored evenly from 0 to 100. The fields investigate pain, appearance, activity, recreation, swallowing, chewing, speech, shoulder, taste, saliva, mood, and anxiety. There are also four questions about overall QoL, in which patients are asked to consider also social factors. The final score is expressed as a percentage of a weighted average, where 0 corresponds to the worst QoL and 100 to the best [7].

Statistical analysis

Statistical analysis was performed using dedicated software (Statistical Package for the Social Sciences Version 15, SPSS Inc., Chicago, IL, USA). Descriptive statistics of the sample and tumor characteristics are summarized in Table 1. Kaplan–Meier methods were used to estimate the 5-year DSS, the 5-year Local Control (LC), and the 5-year LRC for each group. The log-rank test was used to compare the survival curves. For each considered independent variable (as listed in Table 1), the frequencies of patients by surgical approach (DR versus EBR) were compared with the Chi-squared and Fisher's exact tests. The average 6-month QoL scores, as well as each item of the questionnaire, were compared between the two groups (DR vs EBR) with a Mann–Whitney *U* test. The level of significance for all tests was set at $p < 0.05$.

The abbreviations used are summarized in Table 2.

Results

We excluded seven patients who underwent neoadjuvant therapy for cN3 and 11 patients for whom we had insufficient information. The study finally included 147 patients, 56 (38.1%) female, and 91 (61.9%) male, with a mean age of 64 ± 12 years. In this cohort, 85 patients (57.8%) belonged to the DR group and 62 (42.2%) to the EBR group. Table 1 summarizes the characteristics of the sample and the results of the statistical comparison between the two groups.

The 5-year OS rate of the whole sample was equal to 67.3%. In particular, survival analysis showed significantly higher survival rates in the DR group (Fig. 1; Table 1).

The average 6-month QoL score was lower in the EBR group (78%) than in the DR group (82.1%), but the difference was not statistically different. The detailed comparison between the two groups in terms of QoL items is summarized in Table 3. No statistically significant differences emerged, except for the worse anxiety scores found in the ER group ($p = 0.02$).

Among the considered independent variables, there were no differences in sex, margin status, extracapsular extension, adjuvant therapy, and histopathological tumor grading in terms of surgical approach. In the group of patients treated with a DR, we observed significantly more older patients than in the EBR group (69.6% vs 30.4%: $p = 0.002$ for DR vs EBR).

The T stage classified according to the seventh edition resulted equally distributed ($p =$ N.S.) between early (30 cases) and advanced stages (32 cases).

The advanced stages of T classified according to the eighth edition of the AJCC staging system were more frequently treated with the EBR than the early stages and the difference proved to be statistically significant ($p < 0.001$). Similarly, EBR was performed more frequently to treat N+ stages than N0 stages, and the difference was statistically significant considering both the clinical and the pathological TNM classification ($p = 0.049$ and $p = 0.037$, respectively).

Reconstruction of the surgical defect more often required a microvascular flap in the EBR group (68.4%) than in the DR group (31%), and the difference was statistically significant ($p < 0.001$).

The 5-year LRC rate was 71.4%, 77.6% in the DR group and 62.9% in the EBR group with a statistically significant difference ($p = 0.048$). EBR fails to improve the LRC in both patients with DOI < 10 and those with DOI > 10, as shown in Fig. 2.

Finally, we separately evaluated cT3 stages (that means a DOI > 10 mm by imaging) to compare the surgical approaches and no differences emerged in terms of DFS ($p =$ N.S.).

Discussion

In the present study, we retrospectively analyzed the prognostic value of different surgical approaches to perform oral cancer resection and neck dissection.

The cases treated with EBR resulted in significantly worse DSS, LC, DFS, OS, and LRC compared to the group treated with a DR.

Among the variables considered, there were no significant differences in sex, presence of extracapsular spread, surgical margin status, adjuvant therapy, and tumor grading between the two surgical approach groups (EBR vs DR). On the other hand, the factors that significantly presented differences in terms of surgical approach were age, advanced T stages according to the eighth staging system, clinical and pathological N stage, and free-flap reconstruction.

Finally, the comparison between the 6-month QoL average scores showed a poorer trend in the EBR group, even though the difference was not statistically significant.

Table 1 Characteristics of the two populations

	All, *n* (%)	Type of resection		*p* value (Pearson's chi-square)
		DR, *n* (%)	EBR, *n* (%)	
Patients	147 (100)	85 (57.8)	62 (42.1)	
Sex				
Female	56 (38.1)	28 (50)	28 (50)	N.S
Male	91 (61.9)	57 (62.6)	34 (37.4)	
Age, years				
< 65	68 (46.3)	30 (44.1)	38 (55.9)	0.002
≥ 65	79 (53.7)	55 (69.6)	24 (30.4)	
Location				
Oral cavity (involving tongue and FOM)	119 (81)	71 (59.6)	48 (40.4)	0.000
Oral cavity (involving tongue and FOM and extended to oropharynx)	28 (19)	14 (50)	14 (50)	
Margins status				
Free	124 (84.4)	75 (60.5)	49 (39.5)	N.S
Infiltrated	23 (15.6)	10 (43.5)	13 (56.5)	
Flap reconstruction				
No	71 (48.3)	61 (85.9)	10 (14.1)	0.000
Yes	76 (51.7)	24 (31.6)	52 (68.4)	
Extracapsular extension				
No	121 (82.3)	71 (58.7)	50 (41.3)	N.S
Yes	26 (17.7)	14 (53.8)	12 (46.2)	
Post-surgical RT/CT				
No	88 (59.9)	54 (61.4)	34 (38.6)	N.S
Yes	59 (40.1)	31 (52.5)	28 (47.5)	
cT eighth Ed				
Int	87 (59.2)	60 (69)	26 (31)	0.000
Adv	60 (40.8)	17 (28.3)	43 (71.6)	
pT seventh Ed				
Int	96 (65.3)	66 (68.8)	30 (31.2)	0.000
Adv	51 (34.7)	32 (62.7)	19 (37.3)	
pT eighth Ed				
Int	69 (46.9)	53 (76.8)	16 (23.2)	0.000
Adv	78 (53.1)	32 (41.0)	46 (59.0)	
pN eighth Ed				
pN0	88 (59.9)	57 (64.8)	31 (35.2)	0.037
pN+	59 (40.1)	28 (47.5)	31 (52.5)	
Grading				
G 1–2	95 (64.6)	55 (57.9)	40 (42.1)	N.S
G 3–4	52 (35.4)	21 (40.4)	31 (59.6)	
Survival				
5-year OS	67.3%	76.5%	54.8%	0.010
5-year DFS	71.4%	77.6%	62.9%	0.048
5-year DSS	80.3%	88.2%	69.4%	0.005
5-year LC	82.3%	88.2%	74.2%	0.023
5-year LRC	71.4%	77.6%	62.9%	0.048
5-year LCR with DOI < 10 mm	73.1%	77.9%	63.9%	N.S
5-year LRC with DOI > 10 mm	67.4%	76.5%	61.5%	N.S
cT3-Stage DFS	75.5%	74.1%	76.9%	N.S
UW—quality of life	80	82.1	78	N.S

DR discontinuity resection, *EBR* en-bloc resection, *NS* not significant, *FOM* floor of the mouth, *RT/CT* radiotherapy or/and chemotherapy, *cT eighth Ed Int* stages 1–2 according to TNM eighth Ed, *cT eighth Ed Adv* stages 2–4 according to TNM eighth Ed, *pT seventh Ed Int* stages 1–2 according to TNM seventh Ed, *pT seventh Ed Adv* stages 2–4 according to TNM seventh Ed, *pT eighth Ed Int* stages 1–2 according to TNM eighth Ed, *pT eighth Ed Adv* stages 2–4 according to TNM eighth Ed, *pN eighth Ed N0* no regional lymph-node metastasis, *pN eighth Ed N+* one or more regional lymph node metastasis, *DSS* disease-spe-

Table 1 (continued) cific survival, *LC* local control, *LRC* locoregional control, *DOI* depth of invasion, *OS* overall survival

Table 2 List of common abbreviations

EBR	En-bloc resection
DR	Discontinuous resection
QoL	Quality of life
OSCC	Oral squamous cell carcinoma
OS	Overall survival
DOI	Depth of invasion
LRC	Locoregional control
T–N tract	Tumor–neck tract
DSS	Disease-specific survival
DFS	Disease-free survival
NCCN	National Comprehensive Cancer Network
AJCC	American joint Committee on Cancer
LC	Local control
PMNs	Perimarginal lymph nodes

Particularly, we reported in Table 3 the distribution of the University of Washington QoL Questionnaire scores expressed as mean and median for each item in the two groups. The significantly worse anxiety scores ($p = 0.02$) registered in the ER group are likely due to the greater invasiveness of this surgical approach.

Management of the primary tumor and neck and identification of the main prognostic factors are still a matter of controversy [6, 8, 11–13]. The *en-bloc* T–N resection is an old concept that requires the primary tumor and cervical lymph nodes to be removed in continuity [14]. This technique was described by Calabrese et al. in 2011, and it considers the EBR of the T, the cervical lymph nodes, and the T–N tract, that is the fibro-fatty glandular-stromal connection including the sublingual gland, the neurovascular pedicle, and the stromal-lymphatic tissues joining the oral tumor to the cervical lymph nodes [15–17].

This approach has been recently revised and adopted by a group of researchers who applied the compartmental sarcoma surgery concept to tongue cancer surgery, to investigate the prognostic importance of the T-N tract [8, 11].

Specifically, they conducted a standardized anatomopathological analysis to evaluate the T–N tract in the specimens after tongue surgery and they correlated T–N tract involvement with locoregional recurrence and OS. The results showed that malignancy in the T–N tract was related to an increased risk of distant metastasis and death, whereas there was no relation with LRC.

Alongside this philosophy, the minimally invasive discontinuous approach to oral cancer is a re-emerging technique that supports a more conservative treatment. A unique feature of this approach is the preservation of the anatomical separation between the oral cavity and cervical spaces [18, 19]. The traditional surgical approach of wide resections with 1–2 cm macroscopic surgical margins is being superseded by the introduction of minimally invasive transoral surgery principles. According to this emerging technique, the intraoperative evaluation of superficial resection margins is guided by narrow-band imaging, leading to tailored resections that have improved, in our

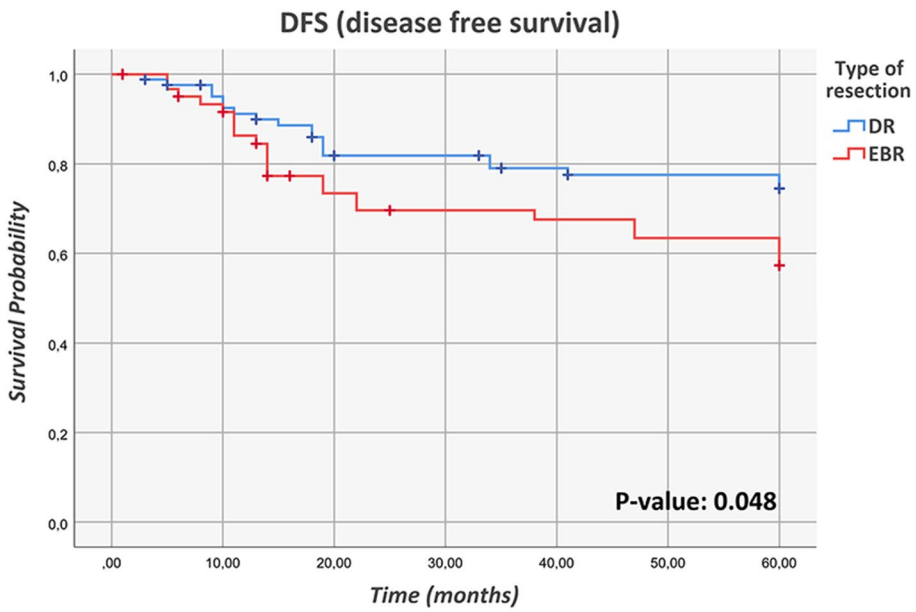

Fig. 1 5-years disease-free survival in the two groups. *DR* discontinuous resection, *EBR* en-bloc resection

Table 3 Comparison between the two groups in terms of University of Washington QoL items presented as mean and median values

	ER ($n=62$)		DR ($n=85$)		p value
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	
Pain	94.8 (14.2)	100 (0)	97.5 (7.5)	100 (0)	0.121
Appearance	86.8 (14.4)	100 (25)	86.6 (17.8)	100 (25)	0.885
Activity	88.2 (20.6)	100 (25)	87.0 (22.3)	100 (25)	0.797
Recreation	86.8 (22.8)	100 (25)	88.4 (21.5)	100 (25)	0.738
Swallowing	73.4 (27.2)	70 (30)	75.9 (29.4)	100 (70)	0.611
Chewing	67.9 (26.1)	50 (50)	74.6 (32.6)	100 (50)	0.181
Speech	76.0 (26.2)	70 (30)	80.3 (25.4)	100 (30)	0.350
Shoulder	87.0 (19.7)	100 (30)	86.3 (22.5)	100 (30)	0.931
Taste	81.5 (25.4)	100 (30)	85.8 (23.4)	100 (30)	0.377
Saliva	74.2 (32.0)	100 (70)	83.4 (27.3)	100 (30)	0.091
Mood	75.9 (23.0)	75 (50)	82.4 (21.3)	100 (25)	0.138
Anxiety	67.4 (28.8)	70 (70)	79.4 (27.5)	100 (30)	**0.020**

Bold value indicates significant differences between two groups

ER en-bloc resection, *DR* discontinuous resection, *SD* standard deviation, *IQR* interquartile range

experience, the rate of superficial clear margins [20]. On the other hand, margin mapping has improved the assessment of deep margins by means of strips-and-bowl frozen sections [21–23].

Since no evidence exists as to the superiority of one surgical approach over the others in terms of survival rates, LC and LRC, this retrospective study aimed to evaluate the long-term survival outcomes (OS, DSS, DFS, LC, and LRC) in oral cancers treated with EBR or DR. A recent meta-analysis conducted by Wang et al. investigated whether discontinuous or in-continuity neck dissection to treat SCC of the tongue and floor of the mouth resulted in different LRC rates [24]. The analysis showed that the in-continuity approach had a statistically significantly lower rate of locoregional recurrence than did discontinuous neck dissection in patients with T2–T3 tongue and floor of the mouth tumors. It should be noted that seven out of the eight studies included in the meta-analysis are at least 10 years old, and thus refer to a time in which minimally invasive transoral surgery had not yet been developed.

By contrast, the LC and LRC rates in our cohort were significantly better in the DR group. LRC does not improve with EBR in patients with early T stage (DOI < 10 mm) or in those with advanced T stage (DOI > 10 mm) in our sample, highlighting the importance of tailored resections rather than a more invasive approach when this is not oncologically necessary. Tagliabue et al. reported that involvement of the T–N tract was found in 16% of their cases, but this involvement was not related with regional relapse [8]. Most patients with disease in the T–N tract (84%) were staged as advanced (pT4) according to the TNM seventh edition: one-third of them had direct extension of the primary tumor into the neck and this in itself represents an internationally recognized indication to perform an EBR [9]. In addition, 78% of patients with positive T–N tract had lymph-node metastasis (N+), and among patients with a negative neck, the OS curves did not significantly differ in terms of T–N tract involvement. Given that T–N tract positivity is significantly more likely in patients with N+, that N0 patients showed no differences in survival rates in relation to T–N tract involvement, and that the T–N resection failed to improve either LC or LRC, in our view, there is no sufficient indication to electively remove the T–N tract.

In our opinion, the presence of lymph-node metastasis in the neck is obviously connected to a greater likelihood of involvement of the T–N tract, because this includes the lymphatics between the primary site and the neck, which may harbor tumor cells in transit. Despite the previous reports that T–N tract involvement was unrelated to regional relapse, we would expect that the EBR might improve LRC due to the aggressiveness of the approach that removes the tissue in which metastases tend to occur together with all the potential paths for spread. At the same time, the EBR usually requires a free-flap reconstruction, which increases the rate of postoperative complications and the operation time.

The comparison carried out in our cohort between EBR and DR for oral cancer showed that LRC and survival were equally good for the DR group. Our results may seem to be obvious, because we tend to perform EBR when tumors spread in depth; however, LRC does not improve when using EBR in patients with early T stage (DOI < 10 mm) or in patients with advanced T stage (DOI > 10 mm). This could be due to the fact that the boundary between the tumor site and cervical spaces is the mylohyoid muscle, which anatomically still belongs to the oral cavity; so, to fulfill the oncological radicality criteria, we remove as much tissue as possible/needed above (during the tumor resection phase) and below this muscle (during the neck dissection phase),

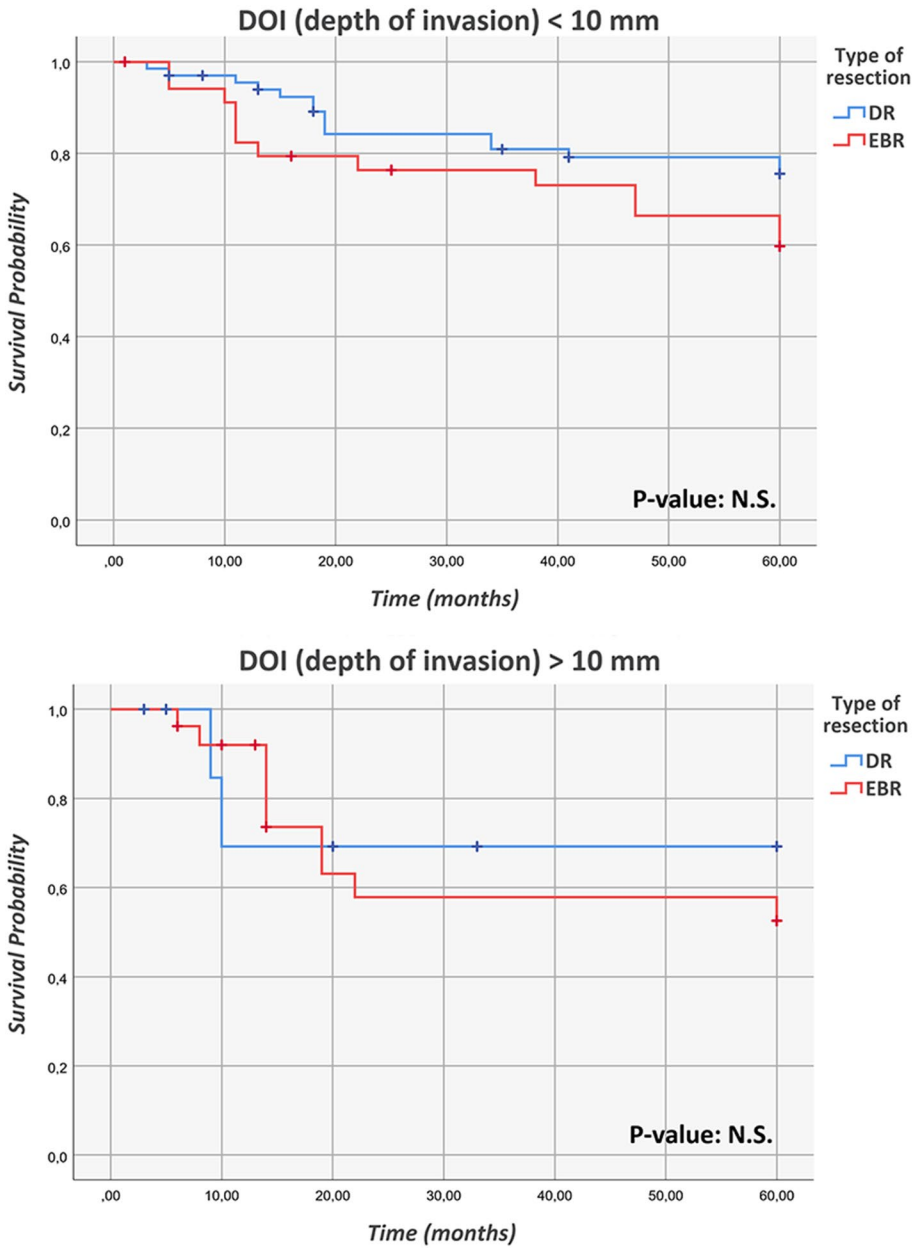

Fig. 2 Locoregional control in the two groups with the sample divided in DOI < ten group and DOI > ten group. *DR* discontinuous resection, *EBR* en-bloc resection, *N.S.* not significant

while attempting to preserve the muscle whenever not involved. Tumor resections were performed transorally to a depth proven to be negative by the frozen sections on the tumor bed; this way, preservation of the mylohyoid muscle, when possible, avoids the need to harvest a free flap for floor-of-the-mouth reconstruction, and the reconstruction is done using a local flap (i.e., facial artery musculomucosal flap). On the other hand, to obtain a radical approach of the area below the muscle, the submandibular area, the neck dissection should include removal of the perimarginal lymph nodes (PMNs) [25, 26]. The submandibular lymph nodes represent the most common site of metastasis in cancer of the tongue and floor of the mouth (up to 39% of cases) and the relapses on lymph nodes in this area are well reported in the literature [26]. In a previous study, we found that PMNs represent a frequent site of micro-metastases (20.5%) in patients diagnosed with oral cancer regardless of the other characteristics of the primary tumor. With a discontinuous approach, the risk of leaving metastatic cells in the T–N tract might be considered averted by the additional treatment of the perimarginal area, which could improve LRC, preserves functionality, and avoids EBR. Preservation of the mylohyoid muscle enables the preservation of the natural separation between the oral cavity and cervical spaces, keeping the risk of fistula formation low, and avoids the need for a free-flap reconstruction with resulting impairment of functional outcome. This surgical approach differs from what other authors [11, 15] perform with the application

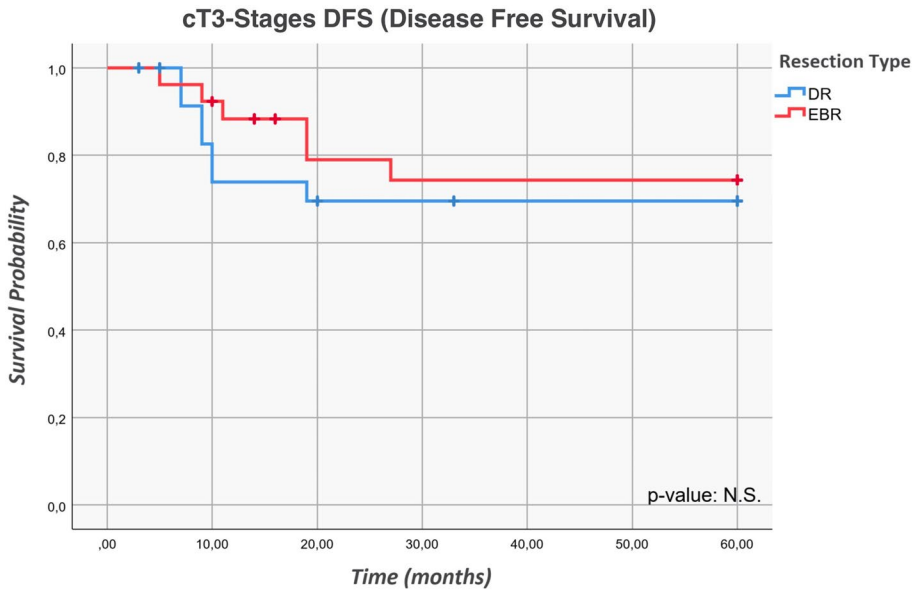

Fig. 3 5-years disease-free survival of the two groups in cT3 stages. *DR* discontinuous resection, *EBR* en-bloc resection, *N.S.* not significant

of a compartmental surgical approach indicated in tumors with a DOI at preoperative imaging greater than 10 mm, irrespective of the superficial extension. The authors sustain that this DOI ensues the involvement of the extrinsic muscles of the tongue, and thus the resection should include the hemitongue, the adjacent floor of the mouth in conjunction with the areolar soft tissues, and lymph nodes; therefore, the authors adopted the 10 mm DOI evaluated by imaging as the ideal cut-off to shift from a transoral approach to a compartmental surgery.

In our cohort, we selected the cT3 (because the treatment indication happens at the moment of clinical staging) that presented a DOI > 10 mm by imaging, irrespective of the superficial extension and no differences emerged from the comparison between the surgical approaches (EBR vs DR) in terms of DFS (Fig. 3).

Evaluation of the independent variables in relation to the surgical approach (Table 1) showed that the percentage of free surgical margins was similar between the two groups (DR vs EBR), meaning that oncological radicality was achieved equally by the two described techniques. This is in keeping with Calabrese et al.'s results concerning surgical margin status [15, 26], but at variance with Ong et al. who stated that the conventional wide surgical resection is insufficient for achieving radicality and suggested a change in resection technique towards a compartmental approach [28]. Comparing the tumor stages, we observed that adopting the eighth edition the pT variable was upstaged in 27 cases (18.4%), equally distributed in the two groups (13 DR patients and 14 EBR patients), while no tumor was downstaged. This type of redistribution had already been found in a previous study of ours, showing that the DOI improves discrimination between T categories. In relation to the T status, in fact, the advanced T stages classified following the eighth edition were treated with an EBR significantly more often than the early stages [29]. This result could support to the idea that more aggressive/advanced tumors require more aggressive surgery to achieve radicality, in contrast to Tagliabue et al. who performed a compartmental surgery with T–N tract removal despite the tumor stage [8].

The percentage of free-flap reconstructions was significantly higher in the EBR group, in agreement with other studies comparing compartmental surgery with the standard approach [10, 15].

In conclusion, in this study, the DR of oral cancer showed that margin mapping by frozen section combined with dissection of the perimarginal lymph nodes, which present micrometasis in nearly 20% of cases, leads to higher LC and LRC compared with the EBR [30]. This approach preserves the natural boundary between the oral cavity and the neck compartment avoiding a free-flap reconstruction, and it has the potential to limit the risk of salivary fistula. Moreover, dissection of the submandibular and perimarginal areas showed an additional improvement in LRC, even though the T–N tract was preserved; in fact it has not been demonstrated that an EBR could be a more protective procedure for locoregional relapse than a DR, except in the case of direct extension of the primary tumor into the neck. In our opinion, the EBR is a valid option to treat selected advanced oral cancers with mylohyoid muscle invasion or cases in which the primary tumor and nodal metastasis develop in continuity or when segmental mandibulectomy is required.

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Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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