ORIGINAL ARTICLE

# Smoking affects quality of life in patients with oral squamous cell carcinomas

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Abstract Smoking is a causative factor in oral squamous cell carcinomas (SCC). Unfortunately, only poor data exist regarding the quality of life of smokers vs non-smokers with SCC. The purpose of this study is to show a correlation between variables for comprehensive interdisciplinary rehabilitation and better patient quality of life (LQ). A total collective of 1,761 patients from 38 hospitals within the German-language area of Germany, Austria and Switzerland (DÖSAK-REHAB-STUDIE) yielding 1,652 patients' questionnaires containing 147 items were evaluated. They refer to the periods before (t1) and immediately after surgery (t2), as well as at least 6 months later (t3). LO was determined by the patient and ranges from 0% to 100%. Significant differences were found between smokers (80%) and non-smokers (20%) with respect to diagnosis, therapy and rehabilitation. Disabilities and impairments in speech, appearance, chewing/swallowing, pain and LO were examined. Smokers were more often and more severely affected. Differences were found in the size of the tumour, scar tissue, ingestion, functionality of the facial muscles and a numb feeling in the head and shoulder area.

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G. Krüskemper (⊠) Himmelgeister Str. 201, 40225 Düsseldorf, Germany e-mail: krueskem@uni-duesseldorf.de Smoking has a severe effect on the oral cavity. Nonsmokers suffer far less from the effects of SCC and the ensuing therapy. During therapy and rehabilitation, the LQ is much higher in non-smokers. This supports the importance of enhanced efforts to inform people about the consequences of smoking so as to prevent them from smoking. Moreover, psychological support might be helpful to give up smoking.

Keywords Smoking  $\cdot$  Tumour stage  $\cdot$  Functionality  $\cdot$  Quality of life  $\cdot$  Side effects

## Introduction

The high risk for a smoker of developing a carcinoma of the oral cavity has long been known [1-6]. The correlation between the severity of the disease and the amount and duration of smoking has been investigated, also in conjunction with alcohol consumption [7-10]. Differences between men and women and young and old patients were the subject of research in the 1990s [11-13]. In the first 10 years of this century, on the other hand, it was attempted to clarify the connection between smoking and the need for rehabilitation, but there were scarcely any more exact and detailed analyses [8, 14, 15]. However, such are important for comprehensive patient management [16]. This fact is also widely acknowledged but has not yet been put into practice. Interdisciplinary cooperation is, as a rule, understood as cooperation between oral and facial surgeons, radiotherapists and oncologists and also between surgeons and specialists in dental prosthesis [17, 18]. The interdisciplinary work thus mainly refers to disciplines of medicine and dentistry. That is understandable as there is a lack of an exact basis for cooperation between nutritionists, physiotherapists,

psychologists, beauticians and speech therapists [19–24]. That is also supposed to be the task of this investigation of a large population of patients with radically operated carcinomas of the oral cavity at stages 1–4.

A distinction was made between smokers and nonsmokers. The size of the sample and the variety of somatic, social and psychological data permit a separation into subgroups according to the questions asked [25]. Therefore, it is possible to make a statistical investigation of correlations which could not be evaluated in smaller samples because of the small number of patients. Hence, it is, for example, possible to distinguish between older and younger men and women, heavy and not so heavy smokers. The initial findings of recent research concerning these sub-groups are individually refused or confirmed, thus laying the foundation for detailed rehabilitation [26-28]. The requirements for this have yet to be established beyond the interdisciplinary work in medicine and dentistry. Physiotherapies for improving chewing and swallowing are not yet geared to the special needs of patients with carcinomas of the oral cavity [29]. Speech therapists must be engaged in the rehabilitation of patients whose quality of life is severely impaired because they cannot make themselves understood through speech [30]. In many cases, no specialists are available for psychological care in coping with the disease. Nutritionists are not sufficiently consulted in the rehabilitation process [31, 32]. Beauticians can be helpful for patients with scars on their faces and necks. General group psychotherapy, as is common for women with breast cancer, is seldom provided for patients with oral cancer [25]. Individual therapy is necessary for patients with speech disorders, at least at the initial stage. To reduce the number of cosmetic operations, a consultation with a beautician is occasionally-but not frequently enoughoffered as a relief for patients who suffer because of their appearance [30]. In principle, it is evident that a treatment plan integrating the above-mentioned disciplines can help the patients and their relatives to cope with the disease and enhance their quality of life. Since in recent years not only the survival time but also increasingly the quality of life during that time has been considered as signs of success in treatment, an extension of interdisciplinarity is desired by many authors, but this is not yet feasible due to the lack of a basis. The current study aims to improve the planning of the various rehabilitation measures by presenting the needs of different patient groups (e.g., smokers vs non-smokers).

# Material and methods

A total collective of 1,761 patients from 38 hospitals within the German-language area of Germany, Austria and Switzerland (DÖSAK-REHAB-STUDIE) [12] yielding 1,652 patients' questionnaires containing 147 items was evaluated. Seventy-five percent of the patients were men, 25% were women. Sixty-seven percent of the patients belonged to the age group between 51 and 70. All included patients had intraoral tumours. Twenty percent of all 1,652 patients were non-smokers, 80% were smokers. A list of 19 impairments was compiled from the experience of the operating surgeons and included ability to articulate, swallowing and chewing and mobility of the lips, jaws, neck and the shoulder/arm area. Dryness of the mouth, strength, pain, appearance and appetite were also included.

The results refer to the periods before surgery (t1) and immediately after surgery (t2), as well at least 6 months later (t3). Patients' data on size and localisation of the tumour, methods of treatment and reconstruction were supplemented by 1,489 evaluable doctors' questionnaires. Hence, the sample size of 1,652 is referred to when no doctor's data, for instance on tumour size, have to be considered.

Tumour size was determined according to the UICC classification of malign tumours (1987):  $T1 \le 2$  cm, T2 > 2 to 4 cm, T3 > 4 cm, T4 infiltrating neighbouring structures. Quality of life (LQ) was measured on a scale from 0=very poor to 100=very good and divided into three groups (0–49, N=193=13%; 50–74, N=613=41%; 75–100%, N=697=46%) as the lower 33.3% of the scale only contained 17 patients. From the total sample of 1,652 patients, there were 1,503 answers on LQ. The information about LQ was missing for 149 patients. The LQ of smokers and non-smokers was individually calculated, also considering the tumour size and the number of nodules. Here the LQ was divided into the mean "not satisfied" or "satisfied" on account of the wide separation of the sample into 16 sub-groups.

#### Tumour

The data were evaluated with the use of SPSS 18.0. Significant differences between smokers and non-smokers were identified in cross-tabulation using Pearson's chi-square test, correlations and t test. Emphases were determined through standard residuals (SR).

#### Results

Twenty percent of all 1,652 patients were non-smokers, 80% were smokers (76% smoked cigarettes, 3% cigars, 1% pipe). Eight hundred and nine patients smoked up to 20 cigarettes daily; 369 smoked more than 20 cigarettes daily. Six hundred and twenty stated that they had completely stopped smoking 6 months after the beginning of treatment. Forty-two percent (N=677) still smoked, albeit somewhat less. Only 69 of 369 heavy smokers—more than 20 cigarettes daily—continued their rate of consumption. Three hundred smokers had reduced their smoking. Only smokers identified tobacco consumption as the main cause of their illness (p<0.000 Pearson's chi-square test)—probably as a consequence of information given by their doctors.

There were significant differences between men and women concerning their smoking habits prior to the disease (p < 0.000, Pearson's chi-square test): prior to treatment, men smoked more (87%) than women (56%). Six months after surgery (t3), 45% of men and 27% of women were still smoking (Table. 1). Table 2 indicates the number of cigarettes smoked before diagnosis and at point t3. Differences before diagnosis are highly significant, mainly due to the fact that women are considerably more frequent within the group "up to ten cigarettes" (SR 5.2). The category "up to 20 cigarettes" displays no differences prior to operation. In the groups of very heavy smokers, there are noticeably more men than women. This remains unchanged at point t3, however with an overall diminished cigarette consumption (Table 2, lower segment).

Significant differences (p < 0.000) according to age groups were more complicated to determine. Standardised residuals indicate that the up to 40 age group is much more often to be found among the non-smoking group (SR 2.2). Most smokers, 720 persons (60%), are from the 41–60 age group (SR 3.2) (data not shown).

Smokers and non-smokers were significantly distinguished by tumour size (Table 3, p < 0.001). Most non-smokers (112 of 284 (39%)) displayed tumour size T1 (SR 2.7), whereas most smokers (484 of 1,121 (43%)) presented tumour size T2. Non-smokers showed a significantly more favourable diagnosis in the lymph node status (pN) as well (Table 3, p <0.001). In agreement with these findings, the late stages of cancer (stage III and IV) are significantly (p < 0.030) more frequent in smokers (54%) than in non-smokers (45%). There were no discrepancies between the groups of those who stopped smoking shortly before the diagnosis and those who did not stop at all. Differences become significant once the group of patients who never smoked are compared with smokers. This is especially true for the larger proportion of non-smokers within the group of small tumours (T1) and of the smaller proportion in the group (T2). The number of nonsmokers decreases with increasing tumour size. Neighbouring

Table 1 Percentage of male and female smokers prior to operation (t1) and at least 6 months after operation (t3)

	Before (t1) (%)	After (t3) (%)
Men	87	45
Women	56	27

 Table 2
 Percentage of daily smoking amount distinguished by gender

	Up to 10 cigarettes (%)	Up to 20 cigarettes (%)	Up to 40 cigarettes (%)	More than 40 cigarettes (%)			
Daily to	bacco consump	tion <i>before</i> diag	nosis (t1)				
Men	14	51	27	8			
Women	34	50	13	3			
Daily tobacco consumption after surgery (t3)							
Men	45	43	10	2			
Women	59	38	2	1			

structures (T4) may also be affected in the case of smaller tumours.

Sixty-two percent of non-smokers present a post-canine tumour localisation (SR 2.4, p < 0.000). There is also a significant difference between smokers and non-smokers concerning side localisation: tumours of smokers show a tendency to involvement of both sides of the oral cavity. All patients received surgical treatment. This was the main treatment modality. Whereas there was a significant difference (p < 0.026) regarding additional radiotherapy between smokers (52%) and non-smokers (44%), no differences could be found with respect to additional chemotherapy. Appropriate to the larger tumour size of smokers, this group received the more complex and more invasive treatments. Free flaps were used in 21% of the smokers and only 10% of non-smokers, and a radical neck dissection was performed in 16% of the smokers but only 9% of the non-smokers (p < 0.000).

Moreover, the questionnaire comprised 19 impairments (Table 4) in treatment of oral tumours. These impairments had been regularly identified by oral and maxillofacial surgeons and otorhinolaryngologists. Table 4 shows that at the time before the operation (t1), significant differences between smokers and non-smokers existed only concerning appetite, pain and stomach complaints. Interestingly, smoking is correlated with a worse quality of life after cancer treatment (Table 4). Before treatment, smokers and non-smokers do not differ in most impairment categories. However, at the end of the treatment and about 6 months later, more non-smokers than smokers show no impairments (Table 4). In addition, 81% of non-smokers are capable of ingesting a normal diet by mouth, whereas this is the case with only 68% of smokers (p < 0.000) (Table 5). In contrast, at point t3, at least 6 months after the operation, smokers are obliged to take a liquid or pap diet significantly more often (p < 0.006). Notwithstanding the considerable size of the sample group, no significant difference between smokers and non-smokers concerning the necessity of gastrogavage at t3 could be found. There were in total only 14 patients with this need. Out of 49 patients from the entire sample group who had to be given a percutaneous stomach feeding tube 6 months after the

Table 3 Number and percentage of smokers and nonsmokers distinguished by tumour size and lymph node status

	Smoker		Non-smoker	Significance	
	N	%	N	%	
pT1 N=432	320 (=100%)	74	112 (100%)	26	0.025
pN0	260 (=81%)	74	90 (=80%)	26	
pN1	41 (=13%)	65	22 (=20%)	35	
pN2	18 (=6%)	100	0 (=0%)	0	
pN3	1 (=0.3%)	100	0 (=0%)	0	
pT2 N=576	484 (=100%)	84	92 (=100%)	16	0.088
pN0	276 (=57%)	81	65 (=70%)	19	
pN1	135 (=28%)	88	18 (=20%)	12	
pN2	67 (=14%)	88	9 (=10%)	12	
pN3	6 (=1%)	100	0 (=0%)	0	
pT3 N=172	139 (=100%)		33 (=100%)		0.475
pN0	51 (=36%)	75	17 (=52%)	25	
pN1	37 (=27%)	84	7 (=21%)	16	
pN2	44 (=32%)	85	8 (24%)	15	
pN3	7 (=5%)	87	1 (=3%)	13	
pT4 N=225	178 (=100%)		47 (=100%)		0.074
pN0	68 (=38%)	71	28 (=60%)	29	
pN1	57 (=32%)	85	10 (=21%)	15	
pN2	47 (=26%)	86	8 (=17%)	14	
pN3	6 (=4%)	86	1 (=2%)	14	

operation, 94% were smokers. Impairment caused by scar formation in the face or on the neck is considerably more severe with smokers. Twenty percent of non-smokers and 7% of smokers are not affected by scar formation at all. Eighteen percent of smokers and 11% of non-smokers are very strongly impaired by cicatrisation. Hence, the wish for further plastic surgery is significantly more frequent in smokers (p<0.000).

An impairment of the facial muscles is significantly less frequent in non-smokers (p < 0.001). The function of the muscles of the mouth as well appears better in non-smokers, both concerning the ability to purse the lips (p < 0.003) and the retention of saliva and other fluids (p < 0.002). Whereas 36% of non-smokers have no control over the discharge of saliva or fluids, 47% of smokers suffer from this impairment.

Smokers display significantly more frequent numb or insentient areas on their faces or necks (p < 0.001). This affects the areas of the lower lip (p < 0.000), the throat (p < 0.000) and, within limits, the tongue (p < 0.086).

No differences between the groups of smokers and nonsmokers could be found concerning medication for dryness of the mouth or for pain. One hundred and thirty (44%) of the 294 non-smoking patients had radiotherapy, as well as 579 (52%) of the 1,124 smokers. The difference between smokers and non-smokers is significant (p < 0.026) (Table 5).

No differences, however, could be identified concerning the occurrence of bronchitis or permanent hoarseness.

Although no differences exist in the consumption of pain medication, patients report significant differences in pain of the shoulder area between smokers and non-smokers.

In contrast, pain in the oral cavity, the face, the temporomandibular joint, the throat and the rest of the head are not different for smokers and non-smokers (data not shown). Asked about general impairments, however (Table 4), in both the periods before treatment (t1), directly after surgery (t2) and 6 months after surgery (t3), results indicate that smokers are indeed more affected by pain.

After completion of the tumour treatment, smokers avoid going out in public compared to prior to treatment significantly more frequently than non-smokers (p < 0.003). Smokers shun the public because of problems with eating (p < 0.001) and speaking (p < 0.001) as well as because of their appearance (p < 0.046). They more frequently report problems in their relationships (p < 0.032). This difference becomes even more marked concerning the topic of sexuality (p < 0.000).

Taken together, non-smokers showed less discomfort, which also applies to the periods immediately following surgery (t2) and at least 6 months later (t3). In addition to the three differences at the period t1, significant differences in eight complaints were added at the period t2. At t3, 6 months after the operation, smokers were more severely impaired concerning a total of 13 complaints. In addition to this, smokers now showed a tendency to breathing difficulties (.092). The statistical differences in all these

Table 4 Significance of differences of impairment between smokers and non-smokers at various timepoints

Impairment	No. (%) without impairment in smokers			No. (%) without impairment in non-smokers			Significant differences (p value)		
	t1	t2	t3	t1	t2	t3	t1	t2	t3
Intelligibility of speech for strangers	79.3	7.6	20.3	81.4	13.2	33.7	_	0.000	0.000
Intelligibility of speech for family	81.4	10.3	32.2	81.9	18.3	46.1	-	0.000	0.000
Eating/swallowing	61.7	6.9	22.1	62.1	7.1	32.6	-	0.034	0.000
Mobility of tongue	70.7	10.1	18.5	76.9	16.8	34.7	-	0.000	0.000
Mouth aperture	77.9	15.8	33.8	80.3	16.9	40.3	-	-	0.038
Mobility of lower jaw	79.2	19.9	38.4	81.8	26.4	50.0	-	0.006	0.000
Mobility of neck	81.6	22.4	36.7	85.6	34.3	48.5	-	0.001	0.000
Shoulder-arm mobility	82.7	29.3	35.2	87.3	44.9	50.8	-	0.000	0.000
Gustatory capability	80.2	24.8	44.2	81.5	28.5	48.9	_	_	_
Olfactory capability	88.5	57.0	69.0	90.9	62.7	75.7	-	-	_
Appearance	78.7	13.3	22.1	79.5	19.3	32.1	-	0.009	0.000
Strength	69.5	14.3	31.0	72.2	19.7	41.7	-	0.007	0.000
Appetite	70.2	32.1	54.9	77.4	33.6	68.1	0.043	-	0.000
Breathing	84.8	48.7	64.4	84.9	57.2	72.9	_	0.029	
Pain	51.5	26.3	21.2	44.2	26.4	26.9	0.012	_	0.018
Swelling	58.7	20.9	51.3	50.8	20.0	54.0	_	—	_
Dryness of mouth	71.2	24.6	37.4	71.2	21.6	35.4	_	—	_
Halitosis	74.3	49.9	65.8	71.3	53.0	69.0	_	_	_
Stomach complaints	80.9	65.4	69.8	85.8	73.8	80.1	0.029	0.034	0.001

Significance of differences of impairment between smokers and non-smokers at the points t1 *before* surgery, t2 immediately *after* surgery and t3 *today*, at least 6 months after surgery

points resulted from a greater impairment on the part of the smokers. At t3, the significant differences as a rule derive from the fact that the non-smokers have no impairments in

the variables in question. Smokers thus suffered considerably more in a large variety of health and general issues, both immediately after their surgery and during rehabilitation, as a

Table 5 Significance of differences regarding various skills between smokers and non-smokers at least 6 months after treatment

Skills	No. (%) with	skill in smokers	No. (%) with sl	Significance	
	N	%	N	0⁄0	
Normal diet	835	68	252	81	0.000
Liquid diet	222	17.9	36	11.4	0.006
Pap diet	412	33.3	76	24.1	0.002
Gastrogavage	12	1	2	0.6	_
PEG	46	3.7	3	1	0.012
Scar formation face or neck	88	7	64	20	0.000
Very strong cicatrisation face or neck	216	18	34	11	0.000
No fluid spills out of the mouth	636	52.8	201	63.6	0.002
No sagging corner of the mouth	873	72.5	246	77.8	0.003
Numb or insentient areas face and neck	257	20.8	94	29.7	0.001
Numb or insentient lower lip	566	45.8	108	34.1	0.000
Numb or insentientthroat	547	44.3	103	32.5	0.000
Numb or insentient tongue	384	31.1	83	26.2	_
Radiotherapy	579	52	130	44	0.026
No wish for cosmetic surgery	860	70.8	251	83.1	0.000

direct consequence of their tobacco consumption. Immediately following the operation (t2), no differences regarding pain caused by wound healing could be identified. Six months later, smokers were affected considerably more by pain (p <0.018). This applies to pain in general, although the upper region of the head was examined in special detail. Overall, significant differences are more marked at t3, which indicates that the differences between groups increase as time passes. In this case, this means a lessening of LQ for smokers. Summed up in a score, the 19 impairments in the questionnaire result in a significant drop in LQ for the entire sample group of patients' questionnaires (N=1,652) between t1 and t2 (immediately after surgery). Although LQ increases for both smokers and non-smokers at t3, the increase is less pronounced for smokers. LO never quite reaches the level of t1. Comparing smokers who stopped smoking just when they experienced their cancer diagnosis and smokers who did not stop smoking, there are no significant differences between these two groups regarding the functional outcome. Surprisingly, doctors and patients differ in their statements concerning "absence of tumours today". It can be intimated from the doctors' questionnaires that 53 patients are not free of tumours (5.4% non-smokers and 4% smokers), according to the medical assessment (total of doctors' questionnaires, N=1,489; minus missing data 79=1,410=5%). Following the doctors' questionnaires, the difference between smokers and non-smokers 6 months after their first surgery is not significant.

Abstinence from tobacco is only partially significant for the recurrence of the disease (p<0.099). The period of 6 months which we surveyed is, however, too short for a conclusive result.

Patients' statements on the topic of "absence of tumours" are quite different. Ninety-seven patients (6% of the 1,489 from the doctors' questionnaires) do not know whether they have a new tumour. Two hundred and forty patients (17%) believe that they have a new tumour. According to the doctors' assessments, 94% of patients are free of tumours, but only 77% of patients believe themselves to be. This indicates that many patients are not properly informed about their actual status regarding their disease (SCC). This difference cannot be explained on the basis of the data, especially since fear of a new tumour does not seem to be very pronounced in patients (Table 6).

Regarding the correlation of tumour size and fear of recurrence, the data suggest that other factors beside the rational ones play a part. The assumption that a larger tumour was linked to greater concern over a new one cannot be confirmed after comparison of the two variables (Table 7). There is not even a tendency to greater concern in patients with larger tumours. It is remarkable (SR 2.4) that of 593 patients with a tumour size 2, only 33 (6%) were greatly afraid of a recurrence. Only those 1,489

 Table 6 Doctors' assessment and patients' opinion on recurrence of tumour

Absence of tumours 6 months after surgery	Medical assessment (%)	Patients' opinion (%)		
Free of tumours	96	77		
New tumours	4	17		
Do not know	-	6		

patients for whom a doctors' questionnaire was available could be included in this calculation of tumour size. In the cases of 21 patients, there was no information regarding tumour size or their assessment of concern.

According to the data on second tumours in the *doctors'* questionnaires, there is no correlation (p<0.928) between the groups of patients who never smoked (N=234) [24], who stopped smoking at various points before surgery (N=586) and those who did not stop smoking before their operations (N595). However, a significant difference of opinion can be found in the *patients'* questionnaires on the issue of absence of tumours 6 months after surgery (t3). There is a greater proportion of patients with larger tumours in the group defined as "Recurrence of tumour today (t3)" (SR 2.3). Absence of tumours today and tumour size are significantly different (p<0.033) according to the data presented by doctors (*doctors'* questionnaires). *Patients'* questionnaires presented no significant difference, which suggests greater reliability of the data given by doctors.

## Discussion

The make-up of the group of patients in this study as regards age and gender is comparable to similar studies [1, 3, 5, 6, 11, 13, 28, 33-35]. It is difficult to find average

 Table 7 Patients' concern regarding a new tumour in correlation to tumour size

Tumour size	T1	T2	Т3	T4	N total
No concern at all	78	142	35	33	288
	17%	24%	20%	14%	
Little concern	140	163	61	77	441
	30%	27%	35%	33%	
Moderate concern	143	163	35	71	412
	31%	27%	20%	30%	
Strong concern	78	92	27	38	235
	17%	16%	15%	16%	
Very strong concern	25	33	17	17	92
	5%	6%	10%	7%	
All patients	464	593	175	236	1468
	100%	100%	100%	100%	

percentages of smokers and non-smokers, especially further distinguished by age group and gender. The study at hand shows that smaller tumours in women must be seen in connection with the higher percentage of female than male non-smokers [11]. The significant difference between men and women regarding the amount of tobacco consumed is mainly due to the fact that women can more often be found in the group of those who smoke less than ten cigarettes daily (SR 5.2) (see Table 2). Up to the point of the diagnosis, 87% of male and 56% of female patients were smokers. Six months after surgery, less than a third of female patients still smoked (see Table 1). Half the male patients had not been able to give up smoking at that point [9]. The age group of 41- to 60-year-olds were the heaviest smokers prior to diagnosis.

The diagnosis showed that non-smokers presented significantly more frequently with tumours of up to 2 cm (T1). This is in line with other reports [2, 7, 26, 36]. Whether the significant differences of post-canine localisation in non-smokers are to be seen in connection with tobacco consumption cannot be resolved. Smokers less frequently present post-canine localisation, which could be connected to contact with nicotine [8, 11, 12].

After surgery, non-smokers are more frequently able to eat a normal diet [17, 19, 29]. Smokers are obliged to keep to a liquid or pap diet. Of the 94 patients with a percutaneous stomach tube 6 months after surgery, who had to deal with the ensuing diminution of quality of life, 94% were smokers. Rehabilitation costs are correspondingly higher for smokers. Diagnosis and treatment prompt many patients to stop smoking. Forty-two percent are, however, not able to accomplish this [7]. Three hundred smokers state that they have at least reduced the amount they smoke. As a consequence of information given to them by their doctors, smokers have recognised how dangerous smoking is for them. They identify tobacco consumption as the main cause of their illness. Non-smokers rather identify heredity or harmful environmental influences as aetiological factors. Dentists should be trained to point out the danger of smoking regarding oral cancer [18]. Furthermore, they should contribute to the development and implementation of help programmes for the enormous percentage of people who are unable to stop smoking even in the face of the gravest consequences. These programmes should be designed to be acceptable to this specific group and to help them give up smoking permanently.

Quality of life is further reduced by cicatrisation, dysfunction of the facial muscles, numb areas and psychosocial variables [25, 27, 37]. Smokers are more impaired in all these complaints. Whereas non-smokers continue to go out in public, smokers exhibit a pronounced behaviour of avoidance caused by difficulties with eating and speaking as well as by insecurity due to their appearance [15, 29, 33, 37–39]. There is a great lack of training programmes for swallowing techniques and exercises for the facial muscles as well as speech therapy [5, 14, 30, 31]. Smokers also present a greater alteration as regards sexuality and relationships [25]. Help groups for partners of those afflicted could increase their quality of life.

Smokers are more afflicted than non-smokers by 19 impairments on which mouth, jaw and face surgeons are familiar with from their practice [34]. This is true of the time immediately following surgery but especially so 6 months afterwards. Hence, not only are the objective costs of illness higher for smokers, but also the subjective negative factors for each individual patient. Surprisingly, there seems to be a lack of proper communication with the patients or at least explanation regarding the disease.

In conclusion, smokers need considerably more attention in both treatment and rehabilitation. Since they suffer more in nearly all areas, there is an urgent need for the implementation of nicotine dehabituation programmes. This is of especially great importance in the period prior to illness. Dental practitioners should be called on to inform their patients and those responsible for health policy should promote this fact. The extensive restriction and measures which have recently been implemented in Germany are steps in the right direction. There is, however, a definite lack of counselling and treatment facilities.

**Competing interests** All authors declare that they have no conflict of interest. Especially, there are no competing interests regarding the interpretation or presentation of the above-mentioned data or results.

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