



The personality and quality of life in HNSCC patients following treatment

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Abstract

The aim of the present study was to investigate the association between self-reported quality of life (QoL) and personality in successfully treated primary head and neck squamous cell carcinoma (HNSCC) patients. We determined QoL using the European Organisation for Research and Treatment of Cancer Quality of life Questionnaire (EORTC-QLQ) C30/H&N35, and personality by the Eysenck Personality Inventory (EPI). All patients younger than 80 years who had been diagnosed with HNSCC in Western Norway in the period from 1992 to 1997, and who had survived until 1999, were sampled. 96 patients (a 90% response rate) were included. Questionnaires were also mailed to all Norwegian laryngectomised patients; 104 patients returned the questionnaires (a 50% response rate). The neuroticism scores were test re-test reliable as determined by the neuroticism scores measured at the primary HNSCC diagnosis for a sub-sample ($N=22$) of the included patients. High neuroticism was associated with a low QoL in both patient samples. The neuroticism score was associated with the QLQ-C30 scales (common variance: 17–25%) and all QoL scores in the laryngectomised group (common variance: 11–25%), and the H&N35 symptom scores in the laryngectomised sample. The associations could still be shown when adjustments were made for gender, age, marital status, educational level, number of children and level of treatment. Extraversion was associated with general QoL, physical and emotional scores in the HNSCC patient sample. Radiation therapy in the HNSCC sample was associated with the H&N35 symptom scores, but different ones to those associated with neuroticism. In conclusion, high neuroticism, but not extraversion, is associated with a lowered QoL.

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1. Introduction

There has been a growing interest over the last few decades in the Quality of Life (QoL) of Head and Neck Squamous Cell Carcinoma (HNSCC) patients following therapy [1]. New protocols have been implemented in HNSCC treatment, but these have not resulted in substantially better survival [2]. Determination of QoL following HNSCC therapy is therefore of interest in order to document that an improved outcome during the last 40 years at least applies to QoL [3].

Several definitions of QoL have been proposed. Generally, the definitions have changed from being obser-

ver-based to being based on the perspective of the patients [4,5]. The multiple dimensions of QoL and the importance of symptom-specific, as well as general aspects, of QoL have also been emphasised [4,5]. The European Organisation for Research and Treatment of Cancer (EORTC) has developed QoL questionnaires aimed at cancer patients [5]. These QoL questionnaires have a non-specific part that is common to all cancer diseases [6], together with disease-specific parts and one of these is aimed at HN cancer [7]. These QoL questionnaires fulfill the requirements of a contemporary QoL questionnaire [8–11], and have therefore been used in this study.

The more extensive treatment that HNSCC patients receive, the more reduced QoL becomes. However, this is not well established when referring to general QoL scales one year after successfully completed treatment

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[12]. Furthermore, demographic characteristics of HNSCC patients predict the level of QoL is surprisingly poorly [13]. Thus, the question arises as to which parameters, in addition to the levels of treatment and demographic variables, determine QoL. It is therefore of interest to study the relationships between QoL and the personality of the patients. Psychological conditions like anxiety and depressed mood [14–18], which are both partly determined by personality [19], have been shown to be associated with the QoL of patients treated for HN cancer.

Personality may be defined as those characteristics of the person that account for consistent patterns of feeling, thinking and behaviour [20]. There are several approaches to conceptualising personality [20]. In this study, we have implemented Eysenck's model [21], where the personality dimensions of 'Extraversion' and 'Neuroticism', together with a 'Lie dimension', account for a large part of the variation in personality.

Neuroticism is a broad pervasive dimension of normal personality whereby people vary in their tendency to experience dysphoric emotional states [22]. Individuals high on neuroticism are assumed to be predisposed to worry, regardless of the presence or absence of threats, and to report more subjective health complaints than stable individuals do [23–25]. In Japanese cancer patients, high neuroticism has been shown to be associated with an impaired QoL [26]. Extraverted people, on the other hand, are considered to be sociable, active and talkative and to enjoy change and excitement in their lives [23]. Extraversion has been found to be associated with a subjective well-being [23,27]. It is possible that extraverted people are more able to preserve their QoL when faced with a serious illness due to a better ability to utilise social support and adapt to the changes which HNSCC imposes upon them. We have previously shown that the mean score of neuroticism, but not extraversion, is higher among HNSCC patients than controls and that this was probably due to a higher alcohol consumption [28].

When self-rated quality of life is correlated with other characteristics of the individual, it is often difficult to define what constitutes the general association. The association with treatment should be relatively easy to interpret, such as associations between increasingly dry mouth and radiation therapy level. This is more difficult with psychological, social and demographic variables. How many of the EORTC C30/H&N35 34 scales and items should be associated with a characteristic of the patients before there is a general association? Our aims have therefore been to define domains of several QoL scores that could be analysed simultaneously where associations to the variables mentioned above are investigated. In this way, comparisons between populations may become easier because possible endpoints of the studies would be limited. In addition, such general

domain scores reduce the multiplicity of independent correlations in a QOL study, and thus minimise coincidental significant correlations.

It seems pertinent to study to what extent variable personality, as measured by the Eysenck personality inventory (EPI) scores and EORTC QLQ, are associated with scores in patients successfully treated for HNSCC.

2. Patients and methods

2.1. Patients

2.1.1. General HNSCC patients

We have included all patients diagnosed with HNSCC in Western Norway in the period from 1 July 1992 to 31 December 1997 and below 80 years of age ($N=122$) who had been disease-free for at least one year following therapy. 16 patients were found to be ineligible for the study; of these, 10 were severely mentally disabled, one had a severe psychiatric disease, three had newly diagnosed other serious disease(s) and two had ongoing treatment for osteo-radionecrosis. A further 10 refused to participate. Of the patients included, 12 were laryngectomised. Table 1 shows the site of the neoplasms and Table 2 the TNM stages of the included HNSCC patients. There was a mean of 4 ± 2 years since the primary diagnosis of HNSCC. The HNSCC treatment is given in Table 3. In this series, 22 patients had also answered the EPI questionnaire during the primary hospital stay when the HNSCC disease was initially diagnosed.

2.1.2. Laryngectomised patients

All patients scheduled for laryngectomy in Norway are asked to become members of the Norwegian Society of Laryngectomized (NSL), and normally do so. Mem-

Table 1
Primary tumour site of the HNSCC patients

Localisation	No
Lip	1
Tongue	15
Salivary glands	2
Gingiva	5
Mouth floor	5
Oral cavity	4
Oropharynx	10
Rhinopharynx	2
Hypopharynx	4
Sinus	3
Larynx	42
Unknown primary site	3
Total	96

HNSCC, Head and neck squamous cell carcinoma.

Table 2
TNM stage of the included patients of the HNSCC general population

	N0	N1	N2	N3	Total
T0		1	1		2
T1	37	2	4	1	44
T2	18	4	4		26
T3	5	1	1		7
T4	13	2	2		17
Total	73	10	12	1	96

T0, No known primary site.

bership of NSL is thus widespread among the laryngectomised in Norway. Questionnaires were mailed to all registered members of NSL below 80 years of age ($N=230$) together with a letter stating that the Board of NSL supported the investigation. A second invitation was mailed if the patients did not respond to the first invitation. The questionnaires were returned to the NSL secretariat, where the identification of the actual person was removed before the questionnaires were forwarded to the investigators. About 30 patients returned the questionnaires unanswered because they were members of NSL, but not laryngectomised. 104 patients answered the questionnaires and were included in the inquiry. This represents around a 50% response rate. Several patients did not return the questionnaires presumably because they were unable to answer them appropriately. More than 90% of the laryngectomised patients had received radiation therapy in addition to the laryngectomy. There was a mean of 10 ± 7 years since laryngectomy which gives significantly longer time after treatment, compared with the HNSCC group ($t=7.388$ $P<0.0001$).

2.2. Quality of life inventory

The QOL was determined by employing the EORTC QLQ-C30 version 3.0 [6,9] and the EORTC QLQ-H&N35 aimed at HN cancer patients [7,9]. The answers were given according to a 4-point Likert format, except questions about general health and quality of life, which were given according to a 7-point Likert format. The indexes were scored according to the EORTC guide-

Table 3
Treatment given to the HNSCC patients included in this study

Treatment	Yes	No
Radio-sensitising	5	91
Primary tumour RT	74	22
Neck RT	48	48
Primary tumour surgery	60	36
Neck dissection	34	62
Flap reconstruction	12	84

RT, radiotherapy.

lines. The functional scales and the global scale were transformed so that 100% indicates the best function and 0% the least function of the individual QoL index, whereas the symptom scales were transformed so that 0% indicates the least and 100% the most symptoms.

2.3. Eysenck personality inventory

The neuroticism (24 questions), extraversion (24 questions) and lie score (9 questions) dimensions of the EPI [21] were determined. The subject responds YES or NO to each question. The scales are calculated as sum scores.

The neuroticism scale consists of questions related to mental symptoms such as obsessive thoughts, anxiety, depression and low self-esteem, but also includes somatic symptoms like muscle pain, tachycardia and sleeplessness. The scale assesses adjustment versus emotional instability and identifies individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges, and maladaptive coping responses. The low scorer is characterised as calm, relaxed, unemotional and self-satisfied [20].

Extraverted individuals are judged to be sociable, active, talkative and optimistic. The extraversion measure assesses quantity and intensity of interpersonal interaction, activity level, need for stimulation and capacity for joy. The low scoring individual will be reserved, sober, task-oriented and quiet [20].

The lie scale is based on answers to 9 questions with phrases like: "Have you ever stolen anything?" Although originally introduced as a lie scale, it has later been suggested that the response pattern to this scale may be regarded as a measurement of a personality trait [29], possibly with a focus on handling of moral questions.

2.4. Education level

The level of education was also determined at the interview. The highest formal education was noted and scored according to how many years of education were required to at least reach the noted level of education starting at 7 years of age.

2.5. Statistics

The statistical program package <<Statistical Package for Social Sciences>> (SPSS) was employed (Ver. 10.0; SPSS Inc. Chicago, IL, USA). The Student's t -test, Pearson's r , partial correlation analysis, (multivariate) analysis of variance ((M)ANOVA) or reliability analysis were performed as indicated. Statistical significance was considered if $P<0.05$.

In order to add generalised statements about associations with reported QoL, analyses were also performed

with clusters of the QoL scores grouped together. Cluster sum scores were constructed with either the QLQ-C30 functional, the QLQ-C30 symptom, or the QLQ-H&N35 scores included. The general health/QoL score was analysed separately. The sum scores were further tested by a reliability analysis.

The coherence of the association between neuroticism and QoL across the samples was tested by the neuroticism scores of both samples transformed to quartiles. Then, the sample number and the neuroticism quartile were subjected to MANOVAs as independent variables with the indicated cluster scores as dependent variables. A significant interaction between sample and neuroticism then shows a different association between the groups.

3. Results

3.1. Demographic variables

The general HNSCC group included 75 males and 21 females (mean age 61 ± 11 years) and the laryngectomised group included 89 males and 15 females (mean age 66 ± 10 years). The laryngectomised group was older than the patients of the HNSCC group ($t = 3.01$ $P < 0.003$). The marital statuses of the groups are given in Table 4, and the educational levels of the groups in Table 5. The laryngectomised group had a mean of 2.5 ± 1.4 children and the general HNSCC population patients a mean of 2.4 ± 1.5 children. Twenty-one of the laryngectomised and 25 of the general HNSCC patients were in employment.

3.2. Test re-test Eysenck iersonality inventory (EPI)

Of the included general HNSCC patients, 22 patients had answered the EPI during the diagnostic procedures when the HNSCC disease was diagnosed. Pearson's correlations for the neuroticism test re-test were 0.76 ($P < 0.01$), for the test re-test extraversion 0.22, and for the test re-test lie score 0.44.

Table 4
Marital status of the included patients

	Series	
	HNSCC	Laryngectomised
Married	68	69
Not married	3	7
Divorced	13	10
Widow(er) (living alone)	11	14
Missing	1	4
Total	96	104

3.3. EORTC QLQ psychometrics

The QLQ scores that were built up of more than one response were studied by Cronbach's α . It was shown that all, but the H&N35 'senses' and the C30 'cognitive function', had values above 0.70.

Scores of each cluster were also subjected to a reliability analysis. The QLQ-C30 functional scores had a Cronbach's α of 0.83 (HNSCC patients) and 0.78 (laryngectomised group), the QLQ-C30 symptom scores had a Cronbach's α of 0.83 (general HNSCC group) and 0.78 (laryngectomised group) and the QLQ-H&N35 score had a Cronbach's α of 0.85 (general HNSCC group) and 0.86 (laryngectomised group). Thus, it is valid to calculate the proposed cluster sum scores.

3.4. QoL scores dependent on age and gender

Table 6 shows the QoL scores dependent on gender and age. The QLQ-C30 functional, the QLQ-C30 symptom and the H&N35 cluster sum score correlated inversely with age of the patient ($r = -0.26/0.28/-0.28$; $P < 0.05/0.01/<0.01$) in the general HNSCC group only. In the general HNSCC group, the QLQ-C30 functional, the QLQ-C30 symptom and the H&N35 cluster sum score correlated with gender of the patient ($r = 0.21/-0.026/-0.21$; all $P < 0.05$), i.e. with females reporting lower QoL than men.

3.5. QoL dependent on years passed since treatment

A correlation matrix between the QoL responses and number of years post-treatment was calculated. None of the QLQ cluster sum scores was associated with the number of years since treatment (data not shown).

3.6. QoL scores dependent on performed surgery/radiation therapy or not

Table 3 shows how many patients of the included HNSCC patients were treated by the different modalities. Table 6 shows the QOL scores dependent on surgical treatment, radiation therapy or theapy level

Table 5
Educational status of the included patients

	Series	
	HNSCC	Laryngectomised
Primary school	22	26
Skilled worker	39	28
Secondary school	14	32
College	12	6
Master degree	6	5
Missing	3	7
Total	96	104

Table 6

HNSCC patient Pearson's correlation of QLQ-C30/H&N35 scores/sum scores with surgery, radiation level, gender or age

Quality of life (QOL) scale	Surgery	Radiation therapy	Therapy level	HNSCC		Laryngectomised	
				Gender	Age	Gender	Age
C30 global health/QoL	0.05	0.02	−0.05	0.10	−0.18	0.14	0.01
QLQ-C30 functional scores							
Physical functioning	0.04	−0.04	−0.07	0.34*	−0.27**	0.08	−0.14
Role functioning	0.06	−0.08	−0.11	0.23*	−0.23*	−0.11	−0.12
Emotional functioning	0.13	−0.06	−0.07	0.20*	−0.22*	−0.03	0.00
Cognitive functioning	0.02	−0.05	−0.12	−0.10	−0.17	−0.23*	−0.02
Social functioning	0.03	−0.17	−0.22*	0.10	−0.14	0.15	0.10
Cluster sum score	0.07	−0.11	−0.15	0.21*	−0.26*	−0.06	−0.09
QLQ-C30 symptom scores							
Fatigue	0.00	0.10	0.15	−0.21*	0.38**	−0.03	0.02
Nausea and vomiting	−0.14	0.14	0.10	−0.16	0.22*	0.00	0.03
Pain	−0.02	−0.01	0.05	−0.12	0.12	−0.12	−0.03
Dyspnoea	−0.16	0.12	0.10	−0.15	0.18	0.00	0.07
Insomnia	0.01	−0.05	0.04	−0.25*	0.22*	−0.11	−0.02
Appetite loss	0.12	0.17	0.22*	−0.22*	0.17	0.00	−0.02
Constipation	0.15	0.10	0.25*	−0.14	0.21*	−0.02	0.07
Diarrhoea	−0.20*	0.09	0.02	−0.03	0.19	−0.06	−0.02
Financial difficulties	−0.03	0.02	0.08	−0.23*	−0.03	−0.36***	−0.18
Cluster sum score	0.11	−0.03	0.17	−0.26*	0.28**	−0.13	−0.03
H&N35 QLQ scores							
Pain	−0.13	0.12	0.24*	−0.12	−0.02	−0.06	−0.20
Swallowing	0.04	0.19	0.22*	−0.17	0.29**	−0.22*	−0.12
Senses	0.30**	0.27**	0.43***	−0.08	0.15	0.00	0.04
Speech	−0.04	0.25*	0.24*	−0.16	0.22*	n.a.	n.a.
Social eating	0.20*	0.19	0.32**	−0.30**	0.20*	−0.18	−0.02
Social contact	0.13	0.12	0.24*	−0.13	0.06	−0.08	0.07
Sexuality	−0.17	0.21*	0.07	−0.06	0.45***	−0.11	0.19
Teeth	0.11	0.08	0.14	−0.04	0.15	−0.21*	−0.08
Open mouth	0.13	0.27*	0.36***	−0.10	−0.01	−0.15	0.00
Dry mouth	−0.08	0.31**	0.33**	−0.15	0.03	−0.24*	−0.07
Sticky saliva	−0.03	0.31**	0.29**	−0.03	0.15	−0.24*	−0.13
Coughing	−0.11	0.09	0.08	−0.22*	0.24*	−0.10	0.17
Feeling ill	−0.15	0.09	0.02	−0.15	0.29**	−0.05	0.02
Cluster sum score	0.04	0.33**	0.38***	−0.21*	0.28**	−0.20*	0.01

n.a., Not available. * $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

(sum score of the two former) or not. Radiation therapy was found to be associated with the H&N35 QLQ responses ($r = 0.33$; $P < 0.01$), especially regarding symptoms related to the dryness of mucosa. The therapy level also correlated with the H&N35 QLQ responses ($r = 0.38$; $P < 0.001$), i.e. symptoms related to amount of salivation and opening of the mouth.

3.7. QoL scores versus neuroticism scores

The HNSCC patient and the laryngectomised neuroticism score correlation coefficients with the QoL scores are shown in Table 7. In the HNSCC sample, the QLQ-C30 functional sum score ($r = -0.50$; $P < 0.001$), the QLQ-C30 symptom score ($r = 0.47$; $P < 0.001$), the QLQ-C30 general health/QoL score ($r = -0.50$; $P < 0.001$), but not the QLQ-H&N35 cluster sum score was correlated with the neuroticism scores. The higher the neuroticism score, the lower the QoL score was obtained.

In the laryngectomised group, the QLQ-C30 functional ($r = -0.57$; $P < 0.001$), the QLQ-C30 symptom scales ($r = 0.46$, $P < 0.001$), the QLQ-C30 general health/QoL score ($r = -0.33$; $P < 0.001$) and the QLQ-H&N35 ($r = 0.49$; $P < 0.001$) scores were associated with the neuroticism scores. The higher neuroticism score, the lower the QoL score obtained.

The exact associations between the neuroticism score and the QLQ domains varied between the samples. Therefore, a MANOVA analysis was performed where both series were included. The neuroticism scores were categorised into 4 levels that were computed in the MANOVA analysis as an independent variable. All the QLQ scores belonging to each domain were simultaneously introduced as dependent variables. The age and gender of the subjects were included in the MANOVA analysis as co-variables. The group allocation was introduced as a second independent variable. Table 8 shows that no significant interaction between the neuroticism quartiles and group allocation was detected for the

Table 7
Pearson's correlation of QLQ-C30/H&N35 sum scores by level of personality trait

Quality of life (QOL) scale	HNSCC			Laryngectomised		
	Neurot.	Extrav.	Lie	Neurot.	Extraver.	Lie
Global health/QoL	−0.50***	0.27*	0.08	−0.33**	0.16	−0.14
General QLQ-C30 functional scores						
Physical functioning	−0.33**	0.20*	0.01	−0.39***	0.04	−0.04
Role functioning	−0.40***	0.16	−0.03	−0.20*	0.23*	−0.04
Emotional functioning	−0.53***	0.20*	0.00	−0.60***	−0.06	−0.01
Cognitive functioning	−0.45***	0.13	0.03	−0.40***	−0.02	0.08
Social functioning	−0.24*	0.12	−0.12	−0.31**	0.03	0.13
Cluster sum score	−0.50***	0.21*	−0.03	−0.57***	0.07	0.04
General QLQ-C30 symptom scores						
Fatigue	0.46***	0.00	−0.03	0.48***	−0.05	−0.12
Nausea and vomiting	0.26*	−0.17	0.01	0.33**	0.08	0.04
Pain	0.42***	−0.11	−0.03	0.39***	0.14	0.06
Dyspnoea	0.33**	−0.09	−0.07	0.30**	0.15	−0.04
Insomnia	0.44***	−0.04	0.03	0.40***	−0.02	0.17
Appetite loss	0.19	0.10	0.02	0.37***	−0.02	0.11
Constipation	0.08	−0.07	0.09	0.22*	−0.07	0.05
Diarrhoea	0.30**	−0.21*	−0.04	0.05	0.09	0.09
Financial difficulties	0.33**	0.05	0.15	0.39***	0.12	−0.09
Cluster sum score	0.47***	−0.08	0.03	0.46***	0.07	0.04
H&N35 QLQ scores						
Pain	0.09	−0.04	−0.03	0.37***	0.18	0.02
Swallowing	0.00	−0.06	0.06	0.36**	0.16	−0.02
Senses	0.12	0.07	−0.20*	0.47***	0.00	−0.15
Speech	0.22*	−0.26*	0.12	n.a.	n.a.	n.a.
Social eating	0.01	0.03	0.11	0.49***	0.05	0.05
Social contact	0.28*	−0.24*	0.05	0.48***	−0.04	0.07
Sexuality	0.12	−0.14	0.16	0.27*	−0.17	0.11
Teeth	−0.02	−0.04	−0.05	0.15	−0.04	0.13
Open mouth	−0.16	−0.06	0.05	0.16	0.06	0.08
Dry mouth	0.19	−0.14	−0.17	0.37***	−0.02	−0.04
Sticky saliva	0.07	−0.06	0.00	0.32**	0.02	−0.12
Coughing	0.32**	−0.06	−0.06	0.16	0.11	−0.12
Feeling ill	0.36**	−0.09	0.08	0.42***	−0.05	0.05
Cluster sum score	0.19	−0.13	−0.01	0.49***	0.01	0.01

Neurot., neuroticism; Extrav. extraversion. * $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

QLQ-C30 functional/symptom scores or QLQ-H&N35 scores. Thus, both series showed the same association between the neuroticism and QLQ scores.

In addition, information about educational level and marital status was included for a partial correlation analysis as control variables correlating the level of neuroticism and QoL responses. No changed association was determined between the neuroticism and QoL scores (data not shown).

Scores of all the individual functioning scales correlated with the neuroticism levels, as did all the general symptom scores in at least one of the samples. With the H&N35 scores, the 'feeling ill' and 'social contact' scales correlated significantly in both samples. In the laryngectomised group, even most of the H&N35 scales responses correlated with the neuroticism scores.

An analysis of the neuroticism score obtained at diagnosis ($N = 22$) did not show significant associations between the QOL scores and the neuroticism scores.

Table 8
MANOVA with neuroticism and series (HNSCC or laryngectomised) included as independent variable

Effect	F	Hypothesis d.f.	Error d.f.	Sig.
General QLQ-C30 functional scores				
Neuroticism	5.89	15	522	0.000
Series	2.07	5	172	0.071
Neuroticism* series	1.00	15	522	0.452
General QLQ-C30 symptom scores				
Neuroticism	2.30	27	492	0.000
Series	2.24	9	162	0.022
Neuroticism* Series	0.83	27	492	0.718
H&N35 QLQ scores				
Neuroticism	2.22	36	444	0.000
Series	4.79	12	146	0.000
Neuroticism* Series	0.59	36	444	0.973

* Multiplied.

3.8. QoL scores versus extraversion scores

The extraversion level was not generally associated with the QLQ sum score as measured by correlation analysis between the level of extraversion and QoL cluster sum scores (Table 7). However, the general QoL/health scores were positively associated with the extraversion level in the HNSCC group ($r=0.27$, $P<0.05$). With the HNSCC sample, a significant association could be detected between the degree of extraversion and the general functional QLQ sum score ($r=0.21$, $P<0.05$).

3.9. QoL scores versus lie scores

Correlations were determined between the QoL responses and the EPI lie score. None of the QLQ cluster sum scores were associated with the EPI lie score (Table 7).

4. Discussion

Quality of life (QoL) ratings were studied in a group of survivors of HNSCC carcinoma in Western Norway with tumours diagnosed over a 5-year period from 1992 to 1997. The HNSCC QoL data were based on interviews and had a response rate of approximately 90%. It was at least 1 year since the HNSCC treatment was completed. Thus, the acute effects of treatment should have dissipated [3,30,31]. A second group consisting of mostly laryngectomised Norwegian patients was studied using anonymous mailed questionnaires. This group had a response rate of approximately 50%.

The EORTC QLQ inventory was employed as the QoL measurement instrument. The psychometric properties of the responses turned out to be satisfactory. Previously, we have reported that the EORTC QLQ of these groups did not differ from each other with regard to the QLQ-C30 functional scales [12].

In order to find clusters of the QoL scores, we investigated the inter-relationships between the QLQ-C30 functional, the QLQ-C30 symptom and the QLQ-H&N35 scores, respectively. Sum scores had acceptable Cronbach's α s and, consequently, sum scores were generated to aid in the interpretation of the results. Of course, sum score associations with other variables must always be interpreted in conjunction with the items that carried the association.

This paper reports, with two different samples, a relatively strong association between the degree of neuroticism, and the QLQ scores, i.e. the higher the neuroticism, the lower the QoL. The neuroticism scores were associated with the functional sum score, the general symptom sum score, the general QoL/health score, and to some extent the QLQ-H&N scores. The findings are

in accordance with findings from Japanese cancer patients [26].

The analysis of the individual scores showed that emotional functioning was the score that was most associated with neuroticism among the functional scales, with a common variance of approximately 30%. However, all of the functional scales correlated with neuroticism. Most of the QLQ-C30 symptom scores also correlated with the level of neuroticism. Among the QLQ-H&N scores, the scales 'feeling ill' and 'social contact', as expected, were correlated with the level of neuroticism. Even symptom scales closely related to the expected side-effects of treatment ('dry mouth' and 'sticky saliva') also correlated with the level of neuroticism in the laryngectomised group. This is probably due to the fact that the laryngectomised group is homogenous, i.e. all patients had the same disease and received the same treatment. Possibly the same relationship exists in the general HNSCC group, but cannot be visualised because of 'noise' from other variables, such as the different disease sites.

A positive association was found between the general health/QoL the general symptom sum score and the extraversion score in the general HNSCC sample. Thus, there is some evidence to claim that extraversion is positively associated with the level of QoL in HNSCC cancer patients. There was no evidence for an association between QoL and the EPI lie responses.

The general HNSCC population included patients with diseases originating at many different sites, although all sites included in the sample have much in common in terms of HNSCC tumour biology [32]. On the other hand, the laryngectomised group consisted of patients with one disease site. The relative coherence of the results between the groups concerning QoL scores and the personality trait scores suggest that the demonstrated association between neuroticism and QoL is independent of the disease site in the HNSCC patients.

Personality trait scores are usually judged to be stable in adulthood [33,34]. Correlations between the personality trait scores and the same scores obtained at diagnosis for 22 patients from the general HNSCC group showed that the neuroticism, but not the extraversion scores, had a good test re-test reliability. However, an analysis with only these 22 patients included did not show any significant associations between the QoL scores and the primary or secondary neuroticism scores. Whether this is due to the low number of patients, or to drifts in the neuroticism score items that predict QoL, must be determined by further research.

The age and gender of the patients have been reported to be important determinants of QoL [35]. The present investigation shows that increasing age was associated with a reduced QoL among the general HNSCC group, but not among the laryngectomised. Gender did not generally predict QoL among the groups investigated.

Psycho-social factors, other than neuroticism and extraversion, may explain the association between neuroticism and QoL. Level of education, number of children and the total number of persons in the household, as well as smoking history scores, did not change the relationship between the QoL levels and neuroticism when these variables were introduced as adjusting variables in a partial correlation analysis.

Several investigators have reported relationships between anxiety and mood and QoL in HNSCC patients [14–18]. Levels of both anxiety and mood are associated with neuroticism and with personality as the causal element [19]. It is possible that the observed association between anxiety and mood level and QoL is caused by an elevated neuroticism. A closer study of the nature of this relationship should be performed.

Having received radiotherapy (or not) predicted the H&N sum QoL score, which was the only general significant association found between the treatment mode and QoL scores. It is possible that a more detailed scoring of treatment level would show closer relationships with the level of QoL. The finding that the extent of treatment, at least partly, predicts the QLQ-C30 QoL scores in primary successfully treated HNSCC patients more than one year after treatment completion has been confirmed by other investigators [30,36].

The present investigation shows that if the aim of treatment is to generally improve the QoL of the HNSCC patients, psycho-therapy may be indicated as an integral part of treatment [37], especially as HNSCC patients have higher neuroticism scores than other cancer patients [28]. Investigators have indeed shown that brief psychological treatment may reduce neuroticism [38]. The present findings call for studies where psychological treatment of patients is given within an experimental design in order to study the effect of the QoL levels.

The relationship between neuroticism and QoL reported could be present among other cancer patients. Thus, this relationship warrants study in other cancer patients.

5. Conclusions

Neuroticism, but not extraversion, in HNSCC patients is relatively strongly, inversely associated with the QoL scores of the EORTC-QLQ C30 and H&N35 inventory beyond 1 year after treatment completion. This association is independent of adjustment by age, gender, educational level and the number of persons in the household of the patients.

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