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CHAPTER 6
Linking Oral Health, General Health and Quality of Life

INTRODUCTION

In 1947 the World Health Organization defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity' (WHO 1946). Despite this definition, general health has traditionally been seen as a unidimensional concept, with medicine typically focused on finding the disease and fixing it (the 'find it-fix it' approach) (Kaplan 2003) and with healthcare research relying heavily on objective outcomes of disease, such as morbidity and mortality (Gift et al. 1997). This conventional way of thinking depicts a biomedical model in which the attention is focused on isolated parts of general health (Kaplan 2003). However, by exclusively relying on objective outcomes, the mental and social elements of general health have been disregarded (Gift et al. 1997), thus overlooking the multidimensional nature of general health and its effect on quality of life (QoL) (McGrath et al. 1999). Now, decades later, this conventional approach is being replaced by a more holistic approach, where the complexity of general health is recognized in that 'the whole is more than the sum of its parts' (Aristotle). In this so-called 'outcomes model' the whole is taken into consideration rather than the isolated parts, with the intention to help people live longer and feel better, instead of just living longer (Kaplan 2003). As a consequence, an impressive amount of attention has been given to the psychosocial impact of disease in health assessment.

The concept of oral health has undergone a similar development. In the past, the main focus in dental research also lay on objective outcomes (dental caries or periodontal disease). It is now recognized that, as with general health, these outcomes do not provide an adequate measure of oral health because they neglect the multidimensional character of oral health and its effect on QoL (McGrath et al. 1999).

In acknowledging general health and oral health as multidimensional concepts and as essential factors in QoL, the issue regarding the inter-relationships of these concepts has become much more complex. Therefore, the patients' view is considered imperative and the use of subjective measures has become increasingly important when it comes to general health and oral health assessment. This has led to the use of single items when measuring self-rated general health and oral health. These are considered to be of additional value in understanding QoL and are useful indicators of overall well-being (Benyamini et al. 2004, DeSalvo et al. 2006). Secondly, it has led to the construction of many different health- and oral health-related quality of life instruments (Gift et al. 1995, McGrath et al. 1999).

The most commonly used measure of health-related quality of life (HRQoL) is the RAND-36 (Hays et al. 2001), a Dutch derivative of the American SF-36 (Van der Zee et al. 1996b). This measure contains 35 items dispersed over eight subscales: Physical function, Social functioning, Role physical, Role emotional, Mental health, Vitality, Bodily pain, and General health; and it contains a single item that asks subjects to rate their perceived change in health over a year (Hays et al. 2001). The eight subscales fall under two distinct components, namely a physical component and a mental component. The physical component contains four subscales: Physical function, Role physical, Bodily pain, and General health. The mental component consists of the Social functioning, Role emotional, Mental health, and Vitality scales (Ware 2006).

The Oral Health Impact Profile (OHIP-49), developed by Slade and Spencer (Slade et al. 1994), is one of the most commonly used measures of oral health-related quality of life (OHRQoL). This instrument contains seven dimensions and is based on

Locker's conceptual model of oral health (Locker 1988, Slade et al. 1994), which has its foundation in the 'Classification of Impairments, Disabilities and Handicaps' developed by the World Health Organization (John et al. 2004). These dimensions are hierarchically ordered so that the impacts described by the dimensions are considered gradually more disruptive to one's life (Slade 1997a). The dimensions are Functional limitations, Physical pain, Psychological discomfort, Physical disability, Psychological disability, Social disability, and Handicap. What can be inferred from this model is that, as with the RAND-36, it consists of two components. Namely, an internal component, which focuses more on awareness of limitation or discomfort (Slade et al. 1994) and may be compared to the physical component of the RAND-36; and an external component, which is more focused on interpersonal and social experiences (Slade et al. 1994) and may be compared with the mental component of the RAND-36.

In the course of oral health and general health assessment these two measures have played a prominent role and have therefore been given considerable attention as to their psychometric properties. Both the OHIP-49 and the RAND-36 are considered reliable and valid measures of OHRQoL (Astrom et al. 2006, Van der Meulen et al. 2008) and HRQoL (Van der Zee et al. 1996a, Van der Zee et al. 1996b, Ware 2006), respectively.

Although the concepts oral health, general health, and QoL have thus become an integral part of healthcare research, this has also raised the vital question as to how these concepts are related in the correlational and/or causal sense. There is evidence for specific oral conditions being related to specific medical conditions, such as cancer (Ingram et al. 2005) or diabetes (Sandberg et al. 2003) and several studies deem oral health and general health to be inseparable (Sandberg et al. 2003). It has even been suggested to include oral health in HRQoL measures (Gift et al. 1995). However, is oral health truly to be seen as a component of general health or rather as a concept standing on its own and perhaps merely related to general health under certain circumstances?

The overall aim of this study was to assess the association between oral health, health, and quality of life in a, for reasons to be discussed, relatively healthy population.
More specifically, it is hypothesized that both oral health and general health (i) and OHRQoL and HRQoL (ii) are separate concepts. Moreover, it will be explored to what extent oral health and general health are related to certain domains of QoL.

MATERIALS & METHOD

Participants were psychology freshmen of the University of Amsterdam (UvA). In total 118 freshmen took part, of which 70% were female. The study design was approved by the Netherlands Institute for Dental Sciences (IOT) and by the Department of Psychology (UvA). Subjects took part voluntarily, were able to stop at any given time, and were given the appropriate information concerning the aim and general conclusions of this study.

Health-related quality of life was measured using the RAND- 36. The scores were summed up and transformed according to the guidelines described by the authors of the Dutch scale (Van der Zee et al. 1993), after which they were standardized to range from 0 to 100. A high score indicates a better HRQoL.

oral health-related quality of life was measured using a Dutch translation of the OHIP-49 (Van der Meulen et al. 2008). This measure consists of 49 items, but because subjects were relatively young, three items concerning dentures were excluded, leaving 46

items. The respondents were asked, for each item, how often in the previous 12 months they had experienced a certain problem regarding their teeth or mouth. They responded on a Likert-type scale, which was coded as follows: 4, very often; 3, fairly often; 2, sometimes; 1, hardly ever; and 0, never. Thus, lower scores indicate a better OHRQoL.

Several self-report questionnaires were combined to assess health symptoms, oral health symptoms, general health, and oral health.

The Vragenlijst Onderzoek Ervaren Gezondheid (VOEG), a health questionnaire that has previously been applied in research for the Statistics Netherlands (CBS) (Van Sonsbeek 1990), was used to assess health symptoms. This questionnaire contains 13 dichotomously scored (yes/no) items asking subjects to indicate having particular health complaints. An example is: 'Do you have feelings of fatigue quite often?'

A 12-item questionnaire, which has previously been used in dental health research for the Netherlands Organisation for Applied Scientific Research (TNO) (Kalsbeek et al. 2003), was used to assess specific oral health symptoms such as caries, jaw pain, ulcerations, bad breath or pain. This questionnaire also included a 13th item, to allow subjects to write down other symptoms not included in the questionnaire.

Two single items were administered asking subjects to rate their health and their oral health on a 5-point scale, as follows: 1, very good; 2, good; 3, fair; 4, fairly poor; and 5, poor.

The participants' task was to complete a large battery of questionnaires. This was a mandatory part of their course for which they received study credits. The above-mentioned questionnaires were administered by computer in a random order, alternating with other questionnaires unrelated to this study.

Statistical analyses

Internal consistency was determined by calculating Cronbach's alpha for the subscale scores of the OHIP and the RAND. Frequencies and mean number of reported general health symptoms and oral health symptoms were calculated. The non-parametric Kruskal–Wallis test and Mann–Whitney *U*-tests were used to assess the differences between the categories of self-rated general health (SRGH), with regard to the reported health symptoms and the scores on the subscales of the RAND and the OHIP. The same tests were used to assess the differences between the categories of self-rated oral health (SROH), with regard to reported oral health symptoms and the scores on the subscales of the RAND and the OHIP. Correlations between SROH and SRGH and between the OHIP and RAND subscales were determined by calculating Spearman rho correlation coefficients.

RESULTS

In total 118 subjects completed the questionnaires. No missing values were present because the questionnaire administration was computer driven. Subjects had a mean age of 21.2 yr (standard deviation (SD) = 5.4). The internal consistencies ranged from 0.62 to 0.87 for the OHIP scales and from 0.65 to 0.87 for the RAND scales. These internal consistencies were relatively high considering that a Cronbach's alpha of 0.6 is regarded as acceptable. Table 1 presents the mean subscale scores of both the OHIP and the RAND. The mean scores on the OHIP subscales indicate a relatively good OHRQoL, and the mean scores on the RAND subscales indicate a relatively good HRQoL.

The means and SD values illustrated substantial skewness in both questionnaires, as can be expected considering the present study group.

Table 1. Internal consistencies and subscale scores of the OHIP and the RAND

	Mean (SD) (N=118)
OHIP	
Functional limitations [0-32]	2.7 (2.7)
Physical pain [0-32]	4.9 (5.1)
Psychological discomfort [0-20]	1.8 (2.4)
Physical disability [0-32]	1.2 (3.0)
Psychological disability [0-24]	1.1 (2.4)
Social disability [0-20]	0.5 (1.7)
Handicap [0-24]	0.7 (2.3)
RAND	
Physical function [1-100]	91.4 (13.7)
Social functioning [1-100]	80.4 (20.2)
Role physical [1-100]	78.8 (33.4)
Role emotional [1-100]	78.8 (34.2)
Mental health [1-100]	70.0 (13.0)
Vitality [1-100]	63.2 (14.1)
Bodily pain [1-100]	79.6 (19.5)
General health [1-100]	67.0 (17.0)

Values in square brackets indicate range of possible scores
SD, standard deviation

Table 2 gives the percentage of subjects reporting specific general and oral health symptoms. The results from the VOEG showed that more than 50% of the subjects reported being fatigued and being not rested when getting up. All other general health symptoms were selected by 14 to 35% of the subjects. As for oral health symptoms, caries lesions (16%), gingival problems (18%), ulcerations (21%), problems with eating and drinking (20%) and discoloration of the teeth (21%) were the most prevalent symptoms. All other oral health symptoms were selected by 3 to 14% of the subjects.

Table 3 contains the results of the two single items: the SRGH and the SROH, respectively. Originally these items were scored on a 5-point-scale, but because of the relative positive scoring, it was decided to combine the response categories fair, fairly poor and poor, to one category. More than 75% of the subjects indicated having a good to very good general health, and more that 80% indicated having a good to very good oral health.

Table 3 also shows the mean number of reported general health and oral health symptoms for each category of the SRGH and the SROH, respectively. The results showed that people who rated their oral and general health as fair/poor reported considerably more symptoms than people who rated their oral and general health as good or very good.

Results from the Kruskal-Wallis test support these findings and showed a significant difference between categories of SRGH (H(2) = 12.1, p< 0.01) with regard to the number of reported health symptoms.

Table 2. Incidence of specific general health symptoms and oral health symptoms

Health symptoms	Subject% (N=118)	Oral health symptoms	Subject% (N=118)
Swollen gastric region	27 (n =32)	Caries lesions	16 (n = 19)
Shortness of breath	20 (n =23)	Gingival problems	18 (n = 21)
Pain in chest region	20 (n =24)	Temporomandibular complaints	14 (n = 17)
Musculoskeletal pains	20 (n =24)	Ulcerations	21 (n = 25)
Fatigue	60 (n =71)	Problems eating and drinking	20 (n = 23)
Headaches	34 (n =40)	Missing, loose or fractured teeth	4 (n = 5)
Back pain	33 (n =39)	Distortion of teeth position	9 (n = 10)
Upset stomach	20 (n =24)	Bad breath	5 (n = 6)
Numb feeling/tingling in limbs	21 (n =25)	Sharp edges of the teeth	4 (n = 5)
Being easily tired	35 (n =41)	Bad taste	3 (n = 3)
Dizziness	17 (n =20)	Discoloration of the teeth	21 (n = 25)
Listlessness	21 (n =25)	Pain	6 (n = 7)
Getting up tired and not rested	54 (n =64)		
Sleep disorders	19 (n =22)		
Eye problems	14 (n =17)		

Using Mann-Whitney *U*-tests, these differences were found between the categories 'very good' and 'fair/poor' (*U*= 122, P< 0.01) and between the categories 'good' and 'fair/poor' (*U*= 604, P< 0.01), indicating that the higher the number of reported health symptoms, the worse general health is regarded.

Table 3. Frequencies of self-rated general health (SRGH) and self-rated oral health (SROH) and the corresponding mean scores of general health symptoms and oral health symptoms

	SRGH		SROH	
	Frequency (%)	Mean (SD) health symptoms	Frequency (%)	Mean (SD) oral health symptoms
Very good	19 (16.1)	2.8 (2.8)	40 (33.9)	2.0 (1.0)
Good	72 (61.0)	3.7 (2.7)	56 (47.5)	1.3 (1.1)
Fair- Poor	27 (22.9)	6.3 (4.0)	22 (18.6)	2.6 (1.8)
Total	118 (100.0)	4.2 (3.3)	118 (100.0)	1.4 (1.4)

SD, standard deviation

The same results were found for the categories of SROH with regard to reported oral-health symptoms (H(2) = 14.8, p< 0.01). Using Mann-Whitney *U*-tests, these differences were also found between the categories 'very good' and 'fair/poor' (*U*= 200, p< 0.01) and between the categories 'good' and 'fair/poor' (*U*= 344, P< 0.01), indicating that the higher the number of reported oral health symptoms, the worse the oral health is regarded.

Using the Kruskal-Wallis test, significant differences were found between the categories of SRGH with regard to all the RAND subscales, except for the Role emotional and the Mental health subscales (Table 4). Mann-Whitney *U*- tests were used to follow up these findings. The results showed that differences are particularly apparent between the categories 'good' vs. 'fair/poor' and the categories 'very good' vs. 'fair/poor'. This

indicates that poor general health corresponds to lower scores on these subscales of the RAND. No significant differences were found between the categories of SRGH, with regard to scores on the OHIP subscales.

Table 4. Mean Ranks of the categories of self-rated general health (SRGH) and the subscales of the RAND, and results from the Kruskal-Wallis test and Mann-Whitney *U*-test.

	SRGH			Kruskal-Wallis		Post hoc[a] Between categories SRGH
	1. Very good Mean Rank	2. Good Mean Rank	3. Fair/Poor Mean Rank			
RAND				*H* (df)	p	
Physical function	69.97	65.73	35.52	19.31(2)	<0.001*	2-3††, 1-3†
Social functioning	67.47	63.56	43.06	8.82(2)	<0.01*	2-3†, 1-3†
Role physical	69.76	64.84	38.04	19.06(2)	<0.001*	2-3††, 1-3†
Role emotional	62.18	57.07	64.09	1.41(2)	0.49	-
Mental health	61.00	61.80	52.31	1.57(2)	0.46	-
Vitality	73.32	62.94	40.61	12.23(2)	<0.01*	2-3†, 1-3†
Bodily pain	72.82	63.79	38.69	14.52(2)	<0.01*	2-3†, 1-3†
General health	93.13	65.10	20.91	55.20(2)	<0.001*	1-2††,2-3††,1-3††

* Ranked mean difference is significant at $p < 0.01$ (2-tailed).
[a]Results of the Mann-Whitney *U*-test. Significant differences between categories are presented ($^{\dagger}p < 0.01$, $^{\dagger\dagger}p < 0.001$)
df, degrees of freedom

Table 5. Mean Ranks of the categories of self-rated oral health SROH and the subscales of the OHIP, and results from the Kruskal-Wallis test and Mann-Whitney *U*-test.

	SROH			Kruskal-Wallis		Post hoc[a] Between categories SROH
	1. Very good Mean Rank	2. Good Mean Rank	3. Fair/Poor Mean Rank			
OHIP				*H* (df)	p	
Functional limitations	38.88	63.76	86.16	29.69(2)	<0.001**	1-2††,2-3†, 1-3††
Physical pain	44.53	60.98	82.95	18.36(2)	<0.001**	1-2†, 2-3†, 1-3††
Psychological discomfort	41.46	62.18	85.48	26.90(2)	<0.001**	1-2†, 2-3†, 1-3††
Physical disability	47.51	60.93	77.66	16.10(2)	<0.001**	1-2†, 1-3††
Psychological disability	53.49	60.35	68.27	3.78(2)	0.15	-
Social disability	55.80	57.13	72.27	10.22(2)	0.01*	2-3†, 1-3†
Handicap	54.29	58.53	71.45	8.57(2)	0.01*	1-3†

* Ranked mean difference is significant at $p < 0.05$ (2-tailed).
** Ranked mean difference is significant at $p < 0.01$ (2-tailed).
[a]Results of the Mann-Whitney *U*-test. Significant differences between categories are presented ($^{\dagger}p < 0.01$, $^{\dagger\dagger}p < 0.001$)
df, degrees of freedom

As can be seen in Table 5, using the Kruskal-Wallis test, with regard to all scores on the OHIP subscales, significant differences were found between the categories of SROH, except for the Psychological disability subscale. The results from the Mann-Whitney *U*- tests showed that significant differences are mostly present between the SROH categories 'very good' vs. 'fair/poor'. This indicates that poor oral health corresponds to higher scores on these subscales of the OHIP. With regard to scores on the RAND subscale no significant differences were found between the categories of SROH.

The correlation between SRGH and SROH was small but significant, indicating a moderate relationship ($r= 0.24$, $p< 0.01$). When correlating the OHIP subscales and RAND subscales, the results only showed significant correlations between the OHIP subscale Functional limitations and the RAND subscales Physical function ($r= -0.21$, $p< 0.05$), Social functioning ($r= -0.19$, $p< 0.05$) and general health ($r= -0.21$, $p< 0.05$). However, in absolute sense these correlations are to be considered small.

DISCUSSION

Our main research question was, 'Is oral health truly to be seen as a component of general health or rather as a concept standing on its own and perhaps merely related to general health under certain circumstances?' With regard to this question, two hypotheses were formulated: first, oral health and health are separate concepts; and second, that OHRQoL domains and HRQoL domains are unrelated. In addition, it was explored to what extent oral health and general health affect certain domains of QoL. Based on our results we tend to conclude that oral health and OHRQoL are, to a certain extent, concepts standing on their own.

In this study a student sample was used, which is generally taken as a weakness, but here it served as beneficial to the research question posed. To understand the broad association among oral health, general health, and QoL, when no major health or oral health conditions are present, one needs a relatively healthy population. A young and highly-educated sample, which is expected to have a rather good oral health (Lopez et al. 2006) and general health, would serve that purpose. In this case more than 75% of the subjects rated their oral and general health as good to very good. Although being rated by a single-item measure, research has shown these indicators to be more than adequate for measuring oral health and general health (Benyamini et al. 2004, DeSalvo et al. 2006, Pattussi et al. 2007). Moreover, this is supported by the fact that people's rating of their oral and general health corresponded to the number of symptoms reported. In addition, the test situation was ideally suited for this rationale, for the questionnaires were administered in a random order, alternating with other unrelated questionnaires, to overcome the possibility of potential order effects.

As expected, the results showed general health being related to all HRQoL domains, except to the Mental and Emotional domain (see Table 4). The lack of association between general health and these two domains perhaps lies in the fact that QoL and general health have different determinants. In a meta-analysis, exploring the differences between health status and QoL, it was concluded that the determinants of QoL are mainly mental in nature, whereas general health is largely determined by physical functioning (Smith et al. 1999). A similar result was found between oral health and OHRQoL. While being related to all other domains of OHRQoL, oral health did not appear to be associated with the Psychological disability domain, which is mental in nature as well (see Table 5). Whereas research has shown that people view psychological well-being as an important feature in one's OHRQoL (Kieffer et al. 2008c), this result seems to support that, here too, the psychological aspect is a determinant of OHRQoL rather than that of oral health. To stretch the foregoing argument, research has found that people's perception of their own oral health does not entirely hinge on clinical pathology. It is suggested that only if symptoms

of disease affect a person's functioning do they view their oral health as being impaired (Reisine et al. 1989), thus making physical functioning a determinant of oral health.

Furthermore, no association was found between oral health and the HRQoL-domains, or between general health and the OHRQoL-domains. However, a small, but significant association was found between Functional limitations (an OHRQoL-domain) and Physical functioning (a HRQoL-domain), suggesting that the functioning of the mouth or body could be seen as a link between these concepts.

Overall, the results suggest that oral health and general health are mostly unrelated in this seemingly healthy population. Accordingly, it is suggested that there is an association between oral health and QoL, only if QoL is oral health-related. The same may well be said about general health and QoL. This idea is supported by the results of a systematic review of studies investigating the relationship between oral health and HRQoL. In this review, four out of seven studies concluded that there was a relationship between these two concepts; however, relationships were merely found in studies where subjects had particular health conditions (Naito et al. 2006). It could therefore be argued that if no apparent disease is present, these concepts must be regarded as separate constructs. To go a step further, one could say that the level of awareness of oral health, portrayed in physical functioning, is an important mediator in the relationship between oral health, general health, and QoL.

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