Relationship between dental status and Oral Impacts on Daily Performances in older Southern Chinese people

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Abstract

Objective: The objective of this study was to assess the relationship between different clinical indicators of dental status and an Oral Health-Related Quality of Life (OHRQoL) measure, the Oral Impacts on Daily Performances (OIDP) index, using different scoring formats, among older Southern Chinese people.
Methods: A total of 1,196 dentate people aged 55 years and older, attending routine annual health checkups at Guangxi Medical University Hospital Health Centre in Guangxi, China, participated in the study. They had a face-to-face structured interview and a clinical dental examination. The OIDP index was used to assess the impacts of oral conditions on quality of life. Spearman and Pearson as well as partial correlation coefficients were used to assess, respectively, the unadjusted and adjusted associations of 14 clinical indicators with the overall OIDP score, OIDP intensity, and OIDP extent.
Results: All clinical indicators, except number of filled teeth, were significantly correlated with the OIDP index, after controlling for covariates. However, correlations were weak, ranging between 0.07 and 0.26. The strongest correlation was for the relationship between the number of natural plus replaced teeth and the OIDP index, irrespective of whether the overall OIDP score, OIDP intensity, or OIDP extent was used to measure OHRQoL.
Conclusions: Clinical dental status indicators were related to OIDP, regardless of the scoring format used to calculate the OIDP index. Clinical indicators that included natural plus replaced teeth were more strongly associated with the OIDP index than their corresponding indicators that included only natural teeth.

Introduction

The relationship between clinical indicators of dental status and Oral Health-Related Quality of Life (OHRQoL) measures has been investigated (1-7). In general, the studies found a significant, but weak-to-moderate, relationship between the two measures. However, most studies were on Western populations, and therefore, their results may not be applicable to Eastern populations because of well-known differences in diet, oral health status, and perceptions of oral impacts between Western and Eastern populations (8-13). The findings lead to the hypothesis that the relationship between clinical indicators and OHRQoL measures may differ between populations. Only one previous study has explored the association between dental status and OHRQoL in a sample drawn from an Eastern country. Srisilapanan and Sheiham (8) reported significant associations between a number of clinical indicators and the Oral Impacts on Daily Performances (OIDP) index, however, they did not specifically explore the magnitude and/or the pattern of such relationships. Hence, it remains unclear whether the pattern of relationships between dental status indicators and OHRQoL reported in Western populations is also found in Eastern populations.

There also are some methodological issues in relation to previous studies that need to be taken into account. First, the previous analyses were with participants grouped into different categories, even in the case of continuous

variables such as the number of natural teeth (NNT) or occlusal pairs. Streiner (14) reviewed the weaknesses of this practice and concluded that categorization results in loss of information, reduced power of statistical tests, and increased probability of a type II error. Second, although some studies used the OIDP index to assess oral impacts, they used either the overall OIDP score or the prevalence of oral impacts (5-7). However, characterization of the intensity and extent of the impacts has been recommended as an alternate method of reporting oral impacts using the OIDP index (15). Intensity categorization is based on the highest score on any of the OIDP performances. Therefore, it does not look at the aggregate score of all performances but focuses on the one performance that has been affected most severely by oral conditions. However, the term extent of impacts refers to the number of daily performances affected by oral conditions (15,16). These indicators allow differentiation between individuals with the same overall OIDP score but different pattern of oral impacts in relation to their intensity and number of affected performances. No study has explored the relationship between clinical dental indicators and the intensity and extent of OIDP impacts.

Therefore, the present study was conducted to assess the relationship between clinical indicators of dental status and an OHRQoL measure, the OIDP index, using different scoring formats (overall OIDP score, OIDP intensity, and OIDP extent), among older Southern Chinese people.

Methods

Participants

A community-dwelling sample of 1,196 subjects aged 55 years and over was selected from the 1,276 older people who attended the checkup center of the first Affiliated Hospital of Guangxi Medical University (Nanning, Guangxi Province, China) over a 3-month period for their annual health screening. Subjects were excluded from the study if they refused to participate (46 people) or if they failed to answer correctly two or more questions of the Orientation-Memory-Concentration Test (17) that was used to assess their cognitive functioning. The sample contained only 33 edentulous people. As they were too few to analyze, they were excluded. Therefore, the final sample for the data analysis consisted of 1,196 subjects, corresponding to 93.7 percent of all older people attending the selected hospital for routine checkups during the whole 3-month period of data collection.

Sample size was calculated to allow estimating a significant correlation of 0.10 (absolute value) between any clinical indicator of dental status and the OIDP score, with a 95 percent confidence level and 90 percent statistical power (18). Using these values, the minimum required sample size was 853 subjects. The final sample size was far larger than this value. Ethical approval was obtained from the Ethical Board and Ministry of Public Health of Guangxi, and participants signed a letter agreeing to their voluntary participation.

Data collection

Data were collected through face-to-face structured interviews and clinical dental examinations. A trained interviewer collected data on participants' sociodemographic characteristics (sex, age, occupation, and subjective social status), self-rated general health, and the OIDP index. Participants were classified according to previous occupation into the following: professionals, administrator worker, clerks, services, business, peasants, and others. The first two categories were classified as "non-manual," and the other categories were classified as "manual work" (19). Subjective social status was measured using the MacArthur Scale, which ranges from 1 to 10 (20). Self-rated general health was measured using a 5-point ordinal scale (poor, fair, good, very good, and excellent). The OIDP index assesses the impact of oral condition on nine daily performances, namely, eating, speaking, cleaning the mouth, doing light physical activities, going out, relaxing/sleeping, smiling, emotional stability, and social contact (21). If a participant experienced an oral impact on any daily performance in the last 6 months, then its frequency and the severity of its effect were scored using 5-point ordinal scales. If no impact was experienced, then a zero score was assigned. Performance scores were estimated by multiplying the corresponding frequency and severity scores. The overall OIDP score was the sum of the nine performance scores multiplied by 100 and divided by the maximum possible score (225). The OIDP intensity was estimated as the most severe impact on any of the nine daily performances, ranging from none to very severe intensity (15,16). The OIDP extent was calculated as the number of performances affected by impacts, ranging from 0 to 9 (15).

The original version of the OIDP index was obtained from the authors (University College London, UK) for cross-cultural translation and adaptation into Chinese using the backward-translation technique (22). First, two professionals translated independently the OIDP from English into Chinese. A consensus draft was reached by discussion, and then it was pilot tested on 15 people for sensitivity to local culture and selection of appropriate words. Next, the understanding, feasibility, acceptance, and comprehensiveness of the draft were discussed with a panel of academics, dentists, and lay elderly people. Later, this amended draft was retested on elderly people to assess its final acceptability and understanding. Then, the final draft was translated back into English by another two professionals working independently, and a new consensus version was reached by group discussion. The process finished after the University College

London team compared and approved the back-translated Chinese version with the original questionnaire. Finally, the psychometric properties of the Chinese version of the OIDP index were tested. For criterion validity, higher Chinese OIDP scores were associated with better self-rated general and oral health as well as with lower levels of self-rated dental treatment need ($P < 0.001$ in all cases). In internal reliability analysis, all inter-item correlations were positive and above the minimum recommended level of 0.20 for including an item in a scale (23). The Cronbach's alpha coefficient was 0.76 and did not increase when any of the items was deleted. Finally, test–retest reliability was assessed in 106 participants, with an intra-class correlation coefficient of 0.91.

Four experienced and calibrated dentists conducted the clinical dental examinations. Inter-examiner reliability tests were undertaken on 66 subjects, while intra-examiner reliability tests were conducted on 103 subjects during the data collection. Kappa values ranged from 0.81 to 0.89 for inter-examiner reliability, and from 0.81 to 0.95 for intra-examiner reliability. The clinical dental examination involved the assessment of 14 clinical indicators of dental status: 1) NNT; 2) number of natural plus replaced teeth (NNRT); 3) number of occluding pairs of natural teeth (NOP); 4) number of occluding pairs of natural plus replaced teeth (NOPR); 5) number of posterior occluding pairs of natural teeth (NPOP); 6) number of posterior occluding pairs of natural plus replaced teeth (NPOPR); 7) number of anterior occluding pairs of natural teeth (NAOP); and 8) number of anterior occluding pairs of natural plus replaced teeth (NAOPR). A replaced tooth was defined as a missing tooth replaced by a fixed or removable prosthesis. For the calculation of NPOP and NPOPR, each molar was counted as two occlusal units, thus, the possible maximum number of NPOP and NPOPR was 12. NAOP and NAOPR refer to incisors and canines, and the maximum number of occluding contacts was 6. The other clinical indicators were the following: 9) number of unfilled posterior tooth spaces (NUPS); 10) number of unfilled anterior tooth spaces (NUAS); 11) number of teeth with coronal caries; 12) number of teeth with root caries; 13) number of filled teeth; and 14) number of mobile teeth. The clinical diagnostic indicators for all assessments were based on the system used in the British National Diet and Nutrition Survey for people aged 65 years and over (24).

Statistical analysis

Spearman and Pearson as well as partial correlation coefficients were used to assess, respectively, the unadjusted and adjusted associations of clinical indicators with the overall OIDP score, OIDP extent, and OIDP intensity. Although some variables were not normally distributed, sensitivity analysis showed that the three correlation coefficients led to similar findings. Therefore, partial correlation coefficients were preferred because they allowed controlling for the other determinants of individuals' OHRQoL (i.e., sex, age, occupation, subjective social status, and self-rated general health). For analysis, participants' occupation was categorized as non-manual and manual work, subjective social status was categorized as low (score 1-4) and high (5-10), and perceived general health was categorized as fair or less and good or better.

Results

The study sample included 575 (48.1 percent) male and 621 (51.9 percent) female dentate people, with a mean age of 66.4 $\pm$ 7.6 years. A sociodemographic description of the sample has been published elsewhere (25). Regarding the clinical characteristics of the sample, the mean NNT was 23.2 and the mean NNRT was 25.7. The mean number of decayed and filled teeth was 0.6 and 0.9, respectively, and the mean number of teeth with root caries was 0.2. Other clinical indicators are shown in Table 1.

Oral impacts affecting daily life were common; 718 (60.0 percent) of the 1,196 dentate people reported at least one oral impact in the last 6 months. Eating was the most commonly affected daily performance (56.7 percent), followed by cleaning the mouth (17.3 percent). Impacts affecting light physical activities and going out were uncommon. The overall OIDP score ranged from 0 to 80, with a mean score of 5.9 $\pm$ 7.6 percent. Among those participants with impacts, 16.3 percent and 41.4 percent reported impacts of very severe and severe intensity, respectively. In relation to the extent of impacts, 31.9 percent reported that one daily performance was affected, 17.5 percent reported two affected performances, and 5.7 percent reported three performances, while only 0.1 percent had impacts affecting all nine performances (Table 2).

The unadjusted and adjusted correlations between clinical dental status indicators and the three alternate scoring formats for the OIDP index are shown in Table 3. There were no major variations in the correlation values either when using parametric or nonparametric correlation coefficients or after controlling for covariates. According to the partial correlation coefficients, all clinical indicators except filled teeth were significantly related to the overall OIDP score, OIDP intensity, and OIDP extent. However, correlations were weak. NNT, NNRT, NOP, NOPR, NPOP, NPOPR, NAOP, and NAOPR were negatively correlated with the OIDP index, whereas NUPS, NUAS, number of mobile teeth, number of decayed teeth, and roots were positively correlated with the three OIDP scoring formats. Of all clinical indicators, NNRT had the strongest correlation with the overall OIDP score ($r = -0.26$, $P < 0.001$), OIDP intensity ($r = -0.25$, $P < 0.001$), and OIDP extent ($r = -0.21$, $P < 0.001$).

Table 1 Clinical Characteristics of Older Southern Chinese People (n = 1,196)

Clinical indicators	Mean	Standard deviation	Minimum value	Maximum value
NNT	23.2	5.9	1	28
NNRT	25.7	3.9	1	28
NOP	12.4	5.5	0	18
NOPR	14.2	4.5	0	18
NPOP	7.6	4.1	0	12
NPOPR	8.8	3.6	0	12
NAOP	4.8	1.9	0	6
NAOPR	5.4	1.4	0	6
NUPS	1.9	2.9	0	16
NUAS	0.4	1.4	0	12
Coronal caries	0.6	1.1	0	12
Root caries	0.2	0.7	0	6
Filled teeth	0.9	1.5	0	11
Mobile teeth	1.0	2.1	0	20

NNT, number of natural teeth; NNRT, number of natural plus replaced teeth; NOP, number of occluding pairs of natural teeth; NOPR, number of occluding pairs of natural plus replaced teeth; NPOP, number of posterior occluding pairs of natural teeth; NPOPR, number of posterior occluding pairs of natural plus replaced teeth; NAOP, number of anterior occluding pairs of natural teeth; NAOPR, number of anterior occluding pairs of natural plus replaced teeth; NUPS, number of unfilled posterior tooth spaces; NUAS, number of unfilled anterior tooth spaces.

Discussion

To our knowledge, this is the first attempt to explore the magnitude and pattern of relationships between clinical indicators of dental status and OHRQoL in older people from an Eastern country. We found some commonalities and also some differences from previous studies in Western countries. In line with findings on Western populations (1,4-7), we found significant but weak associations between clinical indicators and the levels of oral impacts on quality of life among older Chinese people. Considering that the most prevalent oral impact was related to difficulty in eating in both the Western studies and the present study, this finding is particularly interesting, as the Chinese diet, unlike Western diets, contains very few hard fibrous foods. Most foods frequently eaten by Chinese people are steamed or boiled and easy to chew. However, this population has been reported to have high levels of eating difficulty (25). It appears that despite the differences in food texture in commonly eaten foods between the different cultures, there are weak associations between clinical indicators of dental status and OHRQoL in older people in Western and Eastern populations.

Table 2 Prevalence, Overall OIDP Score, and Intensity and Extent of Oral Impacts in Older Southern Chinese People (n = 1,196)

Statistics	Overall	Eating	Speaking	Cleaning the mouth	Doing light physical activities	Going out	Sleeping/ relaxing	Smiling	Emotional stability	Social contact
Prevalence of oral impacts										
%	60.0	56.7	7.5	17.3	0.4	0.4	9.9	3.2	3.9	7.3
Overall OIDP score										
Range	0-80	0-25	0-25	0-20	0-20	0-20	0-20	0-25	0-20	0-25
Mean (SD)	5.9 (7.6)	7.4 (7.3)	1.0 (3.7)	2.0 (4.6)	0.1 (1.1)	0.1 (0.9)	1.1 (3.6)	0.5 (2.7)	0.4 (2.0)	0.9 (3.5)
Intensity of oral impacts (%) among those reporting impacts										
Very little	2.5	2.4	2.2	8.2	0.0	0.0	5.9	0.0	12.8	5.7
Little	1.7	1.8	0.0	4.8	20.0	20.0	15.1	7.9	17.0	5.7
Moderate	38.2	40.8	38.9	45.5	0.0	40.0	37.8	26.3	42.6	36.9
Severe	41.4	40.7	43.3	37.2	20.0	0.0	25.2	34.2	17.0	32.2
Very severe	16.2	14.3	15.6	4.3	60.0	40.0	16.0	31.6	10.6	19.5
Extent of impacts (number of performance with impacts)										
Affected	0	1	2	3	4	5	6	7	8	9
%	40.0	31.9	17.5	5.7	2.9	1.3	0.5	0.1	0.0	0.1

OIDP, Oral Impacts on Daily Performances; SD, standard deviation.

Table 3 Correlations between Clinical Indicators of Dental Status and the Overall OIDP Score, OIDP Intensity, and OIDP Extent

	Overall OIDP score			OIDP intensity score			OIDP extent score		
Clinical indicators	Spearman correlation	Pearson correlation	Partial correlation†	Spearman correlation	Pearson correlation	Partial correlation†	Spearman correlation	Pearson correlation	Partial correlation†
NNT	–0.19***	–0.21***	–0.20***	–0.20***	–0.22***	–0.20***	–0.17***	–0.17***	–0.16***
NNRT	–0.23***	–0.27***	–0.26***	–0.23***	–0.27***	–0.25***	–0.19***	–0.21***	–0.20***
NOP	–0.18***	–0.20***	–0.19***	–0.20***	–0.22***	–0.20***	–0.16***	–0.17***	–0.16***
NOPR	–0.22***	–0.24***	–0.22***	–0.23***	–0.25***	–0.23***	–0.19***	–0.19***	–0.18***
NPOP	–0.17***	–0.19***	–0.18***	–0.19***	–0.20***	–0.19***	–0.15***	–0.15***	–0.15***
NPOPR	–0.22***	–0.22***	–0.20***	–0.22***	–0.24***	–0.21***	–0.19***	–0.18***	–0.17***
NAOP	–0.17***	–0.18***	–0.17***	–0.18***	–0.18***	–0.16***	–0.15***	–0.14***	–0.13***
NAOPR	–0.19***	–0.19***	–0.17***	–0.20***	–0.20***	–0.17***	–0.16***	–0.14***	–0.13***
NUPS	0.21***	0.25***	0.23***	0.22***	0.26***	0.24***	0.18***	0.19***	0.19***
NUAS	0.21***	0.24***	0.22***	0.21***	0.22***	0.20***	0.17***	0.17***	0.17***
Coronal caries	0.13***	0.11***	0.09**	0.13***	0.12***	0.10**	0.11***	0.07*	0.07*
Root caries	0.12***	0.09**	0.08**	0.12***	0.13***	0.12***	0.10***	0.07*	0.07*
Filled teeth	–0.03	–0.06	–0.04	–0.04	–0.06	–0.04	–0.01	–0.02	–0.02
Mobile teeth	0.15***	0.11***	0.10**	0.16***	0.13***	0.12***	0.14***	0.10**	0.09**

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

† Adjusted for sex, age, occupation, subjective social status, and perceived general health.

OIDP, Oral Impacts on Daily Performances; NNT, number of natural teeth; NNRT, number of natural plus replaced teeth; NOP, number of occluding pairs of natural teeth; NOPR, number of occluding pairs of natural plus replaced teeth; NPOP, number of posterior occluding pairs of natural teeth; NPOPR, number of posterior occluding pairs of natural plus replaced teeth; NAOP, number of anterior occluding pairs of natural teeth; NAOPR, number of anterior occluding pairs of natural plus replaced teeth; NUPS, number of unfilled posterior tooth spaces; NUAS, number of unfilled anterior tooth spaces.

All clinical indicators except the number of filled teeth were significantly but weakly associated with each of the three different scoring formats of the OIDP index used (i.e., overall score, intensity, and extent of impacts). This consistent pattern throughout the analysis that included a number of clinical indicators shows the robustness of the associations between clinical measures and the OIDP index, and provides support for the use of the different scoring formats of the index. In addition, associations were in the expected direction. That is, better dental status was indicative of lower level of OIDP. The weak associations between clinical indicators and oral impacts partly support the conceptual distinction between health and disease. While clinical indicators measure disease, which is a purely biologic concept, subjective indicators concentrate on health, a concept inclined more toward sociology and psychology (1,21,26,27).

There were three main findings about the pattern of relationships between different clinical measures and OIDP. First, all clinical indicators based on counts of natural plus replaced teeth (NNRT, NOPR, NPOPR, and NAOPR) were more strongly related to oral impacts than their corresponding counterparts based on counts of natural teeth alone (NNT, NOP, NPOP, and NAOP). In fact, NNRT was the clinical indicator most strongly related to the OIDP index. From these findings it appears that the NNT did not give a good picture of the dental status among participants with replaced teeth. As NUPS and NUAS were also significantly associated with oral impacts, all aforementioned findings provide support for the relative importance that prosthodontic treatment may have on daily living in these older Southern Chinese people.

Second, associations with oral impacts on quality of life were similar for NNT and NOP. It has been claimed that the latter clinical indicator is strongly correlated with oral impacts because occluding pairs do not only reflect the number of teeth, but also the distribution of teeth in the mouth, and therefore, it is a better measure of function than NNT (1,2,5,7). As there were considerably more teeth among participants in this sample (Table 1) than in previous studies of this age group, NNT and NOP measured essentially the same construct in this sample. Therefore, the NOP may provide a different and more relevant picture than simply using NNT in populations with considerable tooth loss, as is usual in older adults.

Finally, the three clinical indicators of oral diseases assessed in this study, number of teeth with coronal and root caries as well as number of mobile teeth, were also associated with oral impacts on quality of life. However, they were the clinical indicators most weakly associated with oral impacts. There might be two complementary explanations for this finding. According to the theoretical framework of the OIDP index, oral diseases are located more distally to the disability and handicap level, as assessed by the OIDP index (28), than other clinical indicators based on tooth loss. However, disease does not always negatively affect subjective perceptions of health and well-being, and even when it does, its impact is

influenced by expectations, preferences, material, social and psychological resources, and more importantly, socially and culturally derived values (27).

Overall, the findings provide some support to the idea that there might be differences in the way people from different cultures perceive dental status and oral diseases to affect their daily lives. Cross-cultural variations may play a role in explaining, at least partially, differences found between this sample of older Southern Chinese people and previous studies. Cultural differences in oral impacts have been demonstrated in older adult populations between different European countries, even after adjusting for variations in clinical dental status and sociodemographic factors (12). Therefore, similar or even wider variations can be expected between Eastern and Western populations. However, more studies are required to assess the potential role that cross-cultural influences have in explaining the relationship between clinical dental status indicators and OHRQoL.

There are minor limitations to the present study. The objective was to assess the relationship between clinical indicators of dental status and an OHRQoL measure. Therefore, the study did not require a representative sample. The present analysis included only dentate people, as very few participants were edentate. Consequently, although our findings cannot be generalized to the entire older population of China, they do provide a picture about cross-cultural similarities and differences between Western and Eastern populations. Therefore, further studies should investigate the same comprehensive set of relationships in younger age groups and across different samples from China and other Eastern countries. This research area would also benefit most from studies directly comparing the associations of clinical with perceived measures between samples from Western and Eastern countries.

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