

Oral impacts and their association with tooth loss in Sri Lankan adults

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Objectives: To determine the prevalence of oral impacts and the association between tooth loss and oral impacts in Sri Lankan adults. **Basic Research Design:** A cross-sectional study where the data were collected by means of a pre-tested interviewer administered questionnaire and an oral examination. **Participants:** 916 ≥40 year olds from the Colombo district. **Main outcome measures:** Oral impacts were assessed using a validated Sinhalese translation of the Oral Health Impact Profile-14. **Results:** The prevalence of oral impacts was 27%. The most commonly reported impacts were in the domain of physical pain: “pain” and “uncomfortable to eat”. Of the 14 oral impacts, tooth loss was associated with only 6 impacts. According to the multiple logistic regression analysis, the prevalence of oral impacts was independently associated with the number of missing teeth, missing anterior teeth and the number of natural occluding premolar pairs. **Conclusions:** The number of missing teeth and the position of teeth were associated with the reporting of oral impacts in this sample of adults. As the position of missing teeth was related to oral impacts, it could be concluded that all missing teeth do not have the same adverse effect on the physical and psychosocial well-being of the subjects.

Key words: oral impacts, OHIP-14, adults, tooth loss, Sri Lanka

Introduction

It is well known that oral disorders and their consequences could have a significant effect on the functional, psychological and social well-being of an individual. Therefore measuring functional and psychosocial impacts of oral disorders has recently gained considerable importance in oral health research. Many researchers from both developed and developing countries have described the impact of oral disorders on the functional and psychosocial well-being of individuals (Pallegedara and Ekanayake, 2008; Locker and Quinonez, 2009) while a few have determined the relationships between clinical oral health status and oral impacts (Tsakos *et al.*, 2004). Moreover it has been recommended that clinical indices be complemented with measures of psycho-social impacts when determining treatment needs (Tsakos, 2008) and planning oral health services (Gherunpong *et al.*, 2006). In addition, measures of psycho-social impacts have been used to assess the outcome of clinical interventions (Malden *et al.*, 2008).

Of the clinical oral health status related variables, tooth loss is an important variable that causes oral impacts (Tsakos *et al.*, 2004) and the location and the distribution of missing teeth affect the severity of the impairment (Gerritsen *et al.*, 2010). Tooth loss, particularly missing anterior teeth, has an impact on the satisfaction with appearance, oral comfort and general performance (Al-Omiri *et al.*, 2009). It has been shown that the number of teeth is positively related to the chewing ability (Brennan *et al.*, 2008). In Sri Lanka, tooth loss is high among adults. According to the third National Oral Health survey the prevalence rates of tooth loss among 35–44 and 65–74 year

olds were 81 and 96% respectively (Ministry of Health Care and Nutrition, 2009). However the impact of tooth loss has been assessed only in the Sri Lankan elderly (Pallegedara and Ekanayake, 2008) and it would therefore be of interest to determine the effect of tooth loss on the physical, psychological and social well-being of a wider Sri Lankan adult population. The present study was conducted with the objectives of determining the prevalence of oral impacts and the association between tooth loss and oral impacts in adults aged 40 years and above living in the Colombo district of Sri Lanka.

Method

The data for the present paper were obtained from a broader study carried out to assess tooth loss and its effects on the well-being of Colombo district adults from 3 groups; 20–39, 40–59 and ≥60 year olds. As previous studies have shown that tooth loss was low in the 20–39 year old age group (Ministry of Health, 1997), only the ≥40 year olds were included in the current study.

Ethical clearance for the study was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Colombo. Those living in business premises, prisons, hostels and religious institutions as well as those who were physically and mentally challenged were excluded. Also informed written consent was obtained from all participants.

For this part of the study where the aim was to determine the association between tooth loss and oral impacts, the required sample size was calculated using the formula for comparison of two population proportions. To calculate

the sample size, data from a previous study (Pallegedara and Ekanayake, 2008) were considered. Using the prevalence of impacts in those with ≥ 20 teeth (20%) and < 20 teeth (50%) reported in that study, a level of significance of 5% and a power of 80%, a minimum of 39 subjects were needed per group. Since it was decided to use the cluster sampling method to select the sample, it was necessary to make allowance for the design effect which was considered as 1.5. After making adjustments for the design effect and non-responses (40%) the sample size required was 82 per group with a total of 164 subjects. However the calculated sample sizes for the 2 age groups for the main study (40-59 year olds $n=480$; ≥ 60 year olds $n=480$) were greater than this so that sample of 960 was also adopted for the present study.

Cluster sampling technique - a method of probability sampling - was used to select the sample and when this technique is used it is necessary to include at least 30 clusters to obtain valid data (Kirkwood and Sterne, 2004). As the study population is large and distributed over a wide geographical area, it was decided to select the subjects from 60 clusters to ensure validity.

Administration of health services in the Colombo district is carried out by the Ministry of Health and the Colombo Municipal Council (CMC). The regions under the purview of these two authorities are further divided into Public Health Inspector areas (PHI). Based on the population proportions of the two regions, it was decided to select 17 of the 60 clusters from the CMC area and 43 from the rest of the district. A PHI area was considered a cluster. The probability proportionate to size technique (PPS) was used to identify the required number of clusters from each of the two regions and 7 subjects per age group (480/60) were selected from each cluster. Using the PPS technique and selecting equal numbers from each cluster, gave each individual in the population the same probability of being selected to the sample (Benette *et al.*, 1991).

The households from a selected cluster were identified by the method recommended by the World Health Organization (WHO) for cluster surveys (WHO, 2005). The individuals who satisfied the inclusion criteria were chosen by visiting the selected households in each cluster. Only one person from a given age category was chosen from a household.

Data were collected by means of a pre-tested interviewer-administered questionnaire and oral examination. Oral functional and psychosocial impacts were assessed using a Sinhalese translation of the Oral Health Impact Profile-14 (OHIP-14) scale (Slade, 1997) which had been validated previously (Ekanayake and Perera, 2003). The OHIP-14 consists of 14 items about impacts that could arise as a result of problems in teeth, mouth or dentures and the respondents indicate the frequency of experiencing each impact over the past 12 months on a 5-point Likert-type scale: 0=never, 1=hardly ever, 2=occasionally, 3=fairly often and 4=very often. However, to reduce recall bias a period of 6 months was considered in the present study. The questionnaire also captured information on socio-demographics and oral health behaviours. The oral examination and the administration of the questionnaire were done by the first author. The administration of the questionnaire was followed by an oral examination carried out with the subject seated on an ordinary chair under

natural light. The number of missing teeth, number of natural occluding premolars and molars were noted.

SPSS 13.0 software (SPSS Inc., Chicago, USA) was used for data analysis. The prevalence of oral impacts was determined by the percentage of subjects who reported one or more impacts 'fairly often' or 'very often' while the prevalence of an individual oral impact item was determined by the percentage of subjects who had reported that impact 'fairly often' or 'very often'. The χ^2 test was used to determine the associations between overall prevalence of impacts and the selected variables. Those variables significantly associated ($p < 0.05$) with the overall prevalence of oral impacts in the bivariate analysis were included in a binary multiple logistic regression model (backward stepwise) to determine the independent associations with the dependent variable being prevalence of oral impacts. As the sample sizes were calculated for the different age groups separately, the sample was weighted to represent the actual population proportions of the age groups in the Colombo district and, except in the multiple logistic regression, the weighted base was used in all analyses.

Results

Of the 960 subjects selected to be included in this part of the study, only 916 responded giving a response rate of 95%. Full denture wearers ($n=19$) were excluded from the analysis. When the sample was weighted to represent the actual population proportions of the age groups in the Colombo district, the weighted base consisted of 586 subjects. Table 1 shows the weighted prevalence rates of oral impacts in the sample. The prevalence of oral impacts was 27%. The most commonly reported impacts were in the domain of physical pain (20.5%): "pain" (13%) and "uncomfortable to eat" (13%). Tooth loss was associated with 6 oral impacts: "pain, uncomfortable to eat, felt self-conscious, felt tensed, diet unsatisfactory and had to interrupt meals". The most common impact reported by those with > 12 missing teeth was "uncomfortable to eat" (Table 2). The associations between prevalence of oral impacts and gender, ethnicity and selected variables related to tooth loss are shown in Table 3. The prevalence of oral impacts increased with the increasing number of missing teeth and decreased with the increasing number of natural premolar and molar occluding pairs. Also the presence of anterior spaces was associated with the prevalence of oral impacts but denture wear was not. Table 4 shows the binary logistic regression model for prevalence of oral impacts controlling for the effects of age and ethnicity. Missing teeth, natural premolar occluding pairs and the presence of anterior spaces were independently associated with the prevalence of impacts. The odds of reporting an oral impact was higher in those with ≥ 12 missing teeth ($OR=5.04$; $CI\ 95\% 1.56-16.27$) compared to those without missing teeth. Also the odds of reporting an oral impact were higher in those with 0 ($OR=2.35$; $CI\ 95\% 1.35-4.11$) and 1-2 ($OR=1.97$; $CI\ 95\% 1.24-3.13$) natural premolar occluding pairs compared to those with 3-4 natural premolar occluding pairs. Presence of anterior spaces was also independently associated with the experience of oral impacts.

Table 1. Distribution of subjects who experienced oral impacts fairly or very often

<i>Oral impacts</i>	<i>n</i>	<i>%</i>
Weighted base	586	
Functional limitation	38	6.3
Difficulty in pronouncing words	19	3.2
Taste affected	25	4.3
Physical pain	120	20.5
Pain	76	12.9
Uncomfortable to eat	75	12.7
Psychological discomfort	55	9.3
Felt self-conscious	43	7.3
Felt tensed	26	4.5
Physical disability	26	4.5
Diet unsatisfactory	13	2.1
Had to interrupt meals	21	3.6
Psychological disability	18	3.1
Difficulty in relaxing	12	2.0
Felt embarrassed	10	1.8
Social disability	9	1.6
Felt irritable	6	1.0
Difficulty in doing usual jobs	4	0.7
Handicap	2	0.3
Life less satisfying	2	0.3
Felt totally unable to function	0	0.0
Prevalence of oral impacts	159	27.1

Discussion

The present study assessed the prevalence of oral impacts and the association between tooth loss and oral impacts in Sri Lankan adults aged 40 years and above.

The overall prevalence of oral impacts in this sample was 27% and is higher than what has been reported for adult populations in recent studies. In a Norwegian study 18% of 16-79 year olds had reported that an oral problem had affected at least one daily oral performance (Astrom *et al.*, 2006) while Locker and Quinonez, (2009) found that nearly 20% of Canadians over the age of 18 years had experienced an oral impact. Also the prevalence rates of oral impacts in American and Australian adults were found to be 15 and 16% respectively (Sanders *et al.*, 2009). Several factors may have contributed to the observed differences between studies. They include methodological differences such as variations in the instruments used to record oral impacts and the age range of the samples considered, variations in the burden of oral disease in the different populations and as there is a cultural dimension to the perception of oral impacts (Steele *et al.*, 2004) such differences may have also contributed significantly to the observed variations between studies. When the individual impact items were considered, the most common impacts reported by subjects of the present study were in relation to the domain of physical pain-“painful aching in the mouth and “uncomfortable to eat” (13%). There is a wide variation in the types of oral impacts reported by individuals in different studies. Astrom *et al.* (2006) found that “difficulty in eating” (11%) was the most common impact reported by Norwegian adults while among Canadian adults the most prevalent impact

Table 2. Association between tooth loss and oral impacts

<i>Oral impacts</i>	<i>Number of missing teeth</i>						<i>p value</i>
	<i>0</i>		<i>1-12</i>		<i>>12</i>		
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	
Weighted base (586)		(n=37)		(n=371)		(n=178)	
Pain	3	8.1	33	8.9	40	22.3	<0.001
Uncomfortable to eat	1	2.7	29	7.8	45	25.1	<0.001
Felt self-conscious	3	8.1	13	3.5	27	15.1	<0.001
Felt tensed	1	2.7	7	1.9	19	10.2	<0.001
Diet unsatisfactory	1	2.7	4	1.1	8	4.5	0.04*
Had to interrupt meals	0	0	7	1.9	13	7.3	0.002

p values determined by χ^2 and* Fisher's exact tests

Only impacts significantly associated with missing teeth are presented in the table.

Table 3. Associations between prevalence of oral impacts, demographic and some variables related to tooth loss – weighted data

Variable	Prevalence of oral impacts		p value
	n	%	
Weighted base (n=586)			
Gender			
Male (237)	59	24.9	0.32
Female (349)	100	28.7	
Ethnicity			
Sinhala (476)	131	27.5	0.007
Tamil (74)	12	16.2	
Moor (36)	16	44.4	
Age (years)			
40-59 (433)	107	24.7	0.03
≥ 60 (153)	52	34.0	
Missing teeth			
0 (37)	3	8.1	<0.001
1-12 (371)	71	19.1	
>12 (178)	86	48.0	
Number of natural premolar occluding pairs			
0 (180)	76	42.2	<0.001
1-2 (170)	51	30.0	
3-4 (237)	33	13.9	
Number of natural molar occluding pairs			
0 (273)	100	36.6	<0.001
1-3 (173)	35	20.2	
4-6 (140)	24	17.1	
Missing anterior spaces			
No (374)	72	19.3	<0.001
Yes (212)	87	41.0	
Denture wear			
No (502)	135	26.9	0.75
Yes (84)	24	28.6	

p values determined by chi square test

was related to the domain of psychological disability: “feeling self-conscious” (7%) (Locker and Quinonez, 2009). Social, ethnic and cultural groups differ in their perceptions of oral impacts (Tsakos *et al.*, 2001) so this finding is to be expected.

It was evident from the results that tooth loss was associated with only impacts related to domains of physical pain, physical disability and psychological discomfort. The most common impact reported by those with >12 missing teeth was “uncomfortable to eat” and is an indication that they may have had difficulty in chewing due to loss of teeth. The independent effects of the different tooth loss related variables on oral impacts were determined through multiple logistic regression analysis. According to the magnitudes of the odd ratios, the number of missing

Table 4. Binary multiple logistic regression (backward step-wise) for prevalence of oral impacts – unweighted data

Variable	Odds ratio	95% CI	p value
Missing teeth			
0	1.00		
1-12	2.23	0.74 - 6.71	0.15
>12	5.04	1.56 - 16.27	0.007
Number of natural premolar occluding pairs			
3-4	1.00		
1-2	1.97	1.24 - 3.13	0.004
0	2.35	1.35 - 4.11	0.003
Missing anterior teeth			
No	1.00		
Yes	1.79	1.22 - 2.64	0.003

Model controlled for age and ethnicity

Dependent variable dichotomized as 1 if experienced any impact fairly often/often and 0 did not experience any impact fairly often/often

Nagelkerke R²=19.0%

teeth was the most important factor associated with oral impacts in this sample. Those with >12 missing teeth (fewer than 20 remaining) had reported more impacts than those who did not have any missing teeth. This is in agreement with the findings of a recent systematic review on tooth loss and oral health related quality of life where it has been mentioned that the prevalence of negative impacts increases sharply once the number of teeth falls below 20 (Gerritsen *et al.*, 2010). Previous studies have also shown that the number of missing teeth is significantly associated with the experience of oral impacts in adults (Astrom *et al.*, 2006). According to Tsakos *et al* (2004), the number of natural occluding pairs is a better measurement of oral function than the number of natural teeth. However, in the present study the numbers of occluding natural premolar and molar pairs were considered separately in the analysis rather than the total number of posterior occluding pairs. This would give a better insight into the association between oral impacts and the position of posterior teeth. The results showed that the number of occluding natural premolar pairs was inversely associated with oral impacts but the number of occluding natural molar pairs was not. Similar findings have been reported in relation to chewing ability and satisfaction with the mouth which are measures of functional and psychosocial well-being. Leake (1990) in an early study had reported that the number of functional premolar pairs were more important in determining the chewing ability than the number of molar pairs. In Brazilian adults satisfaction with the mouth was related to the number of premolar pairs present but not to the number of molar pairs (Elias *et al.*, 1990). Sarita *et al.*, (2003) have reported that subjects with intact premolar regions and at least one occluding pair of molars virtually had no chewing complaints while those with 0-2 pairs of occluding premolars had major difficulties in chewing.

Following a systematic review to evaluate the relationship between dentition and oral function, Gottfredsen and Walls (2007) reported that satisfaction is likely to be achieved in people who retain a premolar dentition and there is little increase in satisfaction in those who retained molar teeth. The findings of the present study as well as those from others therefore provide evidence to suggest that the number of occluding premolars pairs is more important in determining the oral health related quality of life of adults than the occluding pairs of molar teeth. In addition, missing anterior teeth was also associated with oral impacts. Similar findings have been reported in other studies (Brennan *et al.*, 2008; Walter *et al.*, 2007). The functions of anterior teeth include biting, speech and aesthetics. Therefore the loss of anterior teeth could compromise these functions particularly aesthetics (Gottfredsen and Walls, 2007) thereby leading to oral impacts.

The study has some limitations. The clinical examination and the administration of the questionnaire to the participants were done by the first author. This may have led to response bias. In the original OHIP-14 scale's recall period of one year was changed to 6 months to reduce the recall bias. Despite this, recall bias may still have influenced the data collected particularly from the elderly.

In conclusion, studies that assessed the relationship between tooth loss and oral-health related quality of life of Asian adults have been mainly confined to elderly populations and this is believed to be the first Asian study assessing oral impacts and their relationships with tooth loss in a sample that consisted of both middle-aged and older adults. The results indicate that over 25% of the sample had an oral impact and the number of missing teeth was strongly associated with the reporting of oral impacts. As the position of missing teeth was related to oral impacts, it could be concluded that all missing teeth do not have the same adverse effect on the physical and psychosocial well-being of the subjects. The study also has clinical implications because it questions whether replacing all missing teeth is really necessary.

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