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# The usefulness of using Ramfjord teeth in predicting periodontal status of a Tanzanian adult population

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#### Abstract

**Objectives:** The only partial mouth index that has been validated against full-mouth examinations in the East African population is the CPITN (Community Periodontal Index of Treatment Needs). Since the Ramfjord index can potentially shorten the examination time by almost half, we evaluated Ramfjord teeth in predicting full-mouth periodontal status of an adult population in Tanzania.

**Material and Methods:** Pocket depth was measured for 192 consecutive patients aged from 15 to 77 years (36 years old on average); 86 (45%) females referred to the Department of Restorative Dentistry, Muhimbili National Hospital, Tanzania between January 1997 and December 1999, and the mean pocket depth for full-mouth and Ramfjord teeth was calculated.

**Results:** The correlation between the mean pocket depth calculated from the fullmouth and Ramfjord teeth was 0.96. The  $\beta$  coefficient for the mean pocket depth measured by Ramfjord teeth to predict the full-mouth mean was 0.94, and was not affected by adjustment for age, missing teeth or sex.

**Conclusion:** This overall high agreement between Ramjford teeth and full-mouth periodontal pocket situation confirms the epidemiological validity of Ramfjord's dental sample in our setting.

### E. G. S. Mumghamba<sup>1</sup>, W. Pitiphat<sup>2,3</sup>, M. I. N. Matee<sup>4</sup>, E. Simon<sup>5</sup> and A. T. Merchant<sup>2,6</sup>

<sup>1</sup>Department of Restorative Dentistry, Faculty of Dentistry, Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania; <sup>2</sup>Department of Oral Health Policy and Epidemiology, Harvard School of Dental Medicine, Boston, MA, USA; <sup>3</sup>Department of Community Dentistry, Faculty of Dentistry, Khon Kaen University, Thailand; <sup>4</sup>Department of Microbiology and Immunology, Faculty of Medicine, Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania; <sup>5</sup>Department of Oral surgery and Oral Pathology, Faculty of Dentistry, Muhimbili University College of Health Sciences, Dar es Salaam, Tanzania; <sup>6</sup>Department of Nutrition, Harvard School of Public Health, Boston, MA, USA

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Partial indices of periodontitis have long been used in clinical and epidemiological studies to predict full-mouth situation (Goldberg et al. 1985, Hunt 1987, Silness & Roynstrand 1988, Ainamo & Ainamo 1994, Benigeri et al. 2000). These indices have been developed and tested in a number of geographical locations among different populations (Baelum et al. 1995). Studies have shown variations in the usefulness of partial-mouth indices of periodontitis in predicting whole-mouth periodontal status (Silness & Roynstrand 1988, Rams et al. 1993, Ainamo & Ainamo 1994, Benigeri et al. 2000). These variations could be attributed, at least in part, to the population differ-

ences in the pattern of periodontal destruction. Thus, despite their potential advantages in epidemiological studies, partial-mouth indices of periodontitis need to be validated in the relevant population before use (Goldberg et al. 1985, Ainamo & Ainamo 1994). The two most widely used partial indices for periodontal surveys are the Community Periodontal Index of Treatment Needs (CPITN) and the Ramfjord teeth (Gilbert 1994). To the best of our knowledge, the only partial-mouth index that has been validated against full-mouth examinations in the East African population is the CPITN (Baelum et al. 1993). Accordingly, all periodontal surveys in the region have used the CPITN index (Baelum et al. 1993, Malisa et al. 1993, Baelum et al. 1995, Scheutz et al. 1997).

The Ramfjord index has an advantage of involving six instead of the ten CPITN teeth, potentially shortening the examination time by almost half. The aim of this study was to evaluate the usefulness of Ramfjord teeth in predicting the full-mouth periodontal status of an adult population in Tanzania.

#### Methods

#### Selection of subjects

The study participants were 192 consecutive patients referred to the Department of Restorative Dentistry, Muhimbili University College of Health Sciences, Tanzania between January 1997 and December 1999, who received fullmouth examinations. The periodontal examinations were conducted by practicing dentists or supervised fourth and fifth year dental students.

#### Measurements

Pocket depth was measured in millimeters with a periodontal probe with William's markings from the base of the pocket to the free gingival margin. We had six measurements of pocket depth for each tooth (mesiobuccal, buccal distobuccal, mesiolingual, lingual and distolingual). Missing teeth were marked on the chart. We excluded all wisdom teeth (teeth numbers 18, 28, 38 and 48) in the analysis. The mean pocket depth per tooth was calculated by summing the measurements per tooth and dividing by the number of measurements. Age and sex information was available for all the participants. The identity of participants was anonymous.

#### Mean pocket depth for full mouth

This was calculated by summing the mean pocket depth per tooth and dividing by the number of teeth.

Table 1. Characteristics of the study population.

	All subjects	Males	Females
N	192	104	86
Pocket depth (mm)			
mean	2.65	2.66	2.65
standard error	0.67	0.71	0.63
range	1.46-5.77	1.46-5.49	1.54-5.77
Age (years)			
mean	35.5	36.2	34.6
standard deviation	14.0	14.6	13.3
range	15–77	17-77	15-70
Missing teeth			
none, N (%)	82 (43)	48 (46)	34 (39)
1-2 missing N (%)	56 (29)	29 (28)	27 (31)
3-5 missing N (%)	25 (13)	12 (11)	13 (15)
6+ missing $N(%)$	29 (15)	16 (15)	13 (15)

Table 2. Pearson's correlation coefficient between full-mouth and Ramfjord teeth means, stratified by gender and missing teeth.

	Correlation coefficients		
	All subjects	Males	Females
total	0.96	0.96	0.97
Missing teeth			
none	0.98	0.97	0.98
1-2 missing	0.96	0.97	0.95
3-5 missing	0.94	0.94	0.93
6+ missing	0.97	0.96	0.98

Mean pocket depth for Ramfjord teeth

This was calculated by summing the mean pocket depth per tooth for the Ramfjord teeth (teeth numbers 16, 21, 24, 36, 41, 44) and dividing by the number of Ramfjord teeth. If a Ramfjord tooth was missing, a substitute tooth was selected as suggested by Fleiss et al. (1987) (teeth numbers 17, 11, 25, 37, 31, 45).

#### Statistical methods

We calculated Pearson correlation coefficients between the mean pocket depths calculated from the full-mouth measurement and from the Ramfjord teeth, further stratifying by categories of missing teeth (None, 1-2 missing, 3-5 missing and 6+ missing), and sex. We then conducted a linear regression analysis with the full-mouth mean as the outcome variable and the Ramfjord teeth mean as the independent variable. We repeated this analysis adjusting for age (continuous), and missing teeth categorical (None, 1-2 missing, 3-5 missing and 6+ missing), and stratifying by missing teeth categories. We also conducted a paired *t*-test to compare the difference in the mean pocket depth

*Table 3.* Coefficients of linear regression for Ramfjord teeth mean to predict full-mouth mean.

Study population	$\beta$ coefficient	<i>p</i> -value
all subjects	0.94	< 0.001
males	0.95	< 0.001
females	0.93	< 0.001

measured from the full-mouth versus Ramfjord teeth, stratifying by sex.

#### Results

Participants ranged in age from 15 to 77 years and were about 36 years old on average; 86 out of 192 (45%) were females (Table 1). Seventy-two percent had two or fewer missing teeth (Table 1). Males and females were similar with respect to age and missing teeth. The mean pocket depth ranged from 1.46 to 5.77 mm, and was 2.65 mm on average. The difference in the mean pocket depth measured from the full-mouth and Ramfjord teeth was 0.00092 mm (p = 0.95) for the total population, 0.00414 mm (p = 0.84) for males and - 0.00296 mm (p = 0.86) for females.

The correlation between the mean pocket depth calculated from the fullmouth and Ramfjord teeth was 0.96 (Table 2). The correlation was higher (0.98) when all the teeth were present, slightly lower (0.94) when 3–5 teeth were missing and increasing slightly when six or more teeth were missing (0.97). There was a similar pattern in males and females (Table 2).

The beta coefficient for the mean pocket depth measured by Ramfjord teeth to predict the full-mouth mean was 0.94 (Table 3). Further adjustment for age and missing teeth did not substantially alter the results, nor did they differ when stratified by sex (Table 3) or missing teeth categories (data not shown).

#### Discussion

This is the first study in the East African region to evaluate the usefulness of Ramfjord teeth in predicting the fullmouth periodontal status. The study, which is based on pocket depth measurements, shows good correlation between Ramfjord teeth and the fullmouth situation and good prediction capacity of these index teeth, in both males and females. The differences in the mean pocket depth measured from the full-mouth and Ramfjord teeth were small and not statistically significant for the total population, and among males, and females.

For both males and females, the correlation between the mean pocket depth calculated from the full-mouth and Ramfjord teeth was high, with slight non-significant variations with the number of missing teeth. The beta coefficient, a statistic that was used to assess prediction of the full-mouth mean pocket depth by Ramfjord teeth, was high and not altered by adjustment for age and missing teeth, nor did it differ when stratified by sex or missing teeth categories.

The participants in this study were self-selected and probably had more severe periodontal disease than the general population because they were referred for periodontal care. We found little underestimation (6%) of the fullmouth mean predicted by the Ramfjord teeth in this study. This is in contrast to the findings of Baelum et al. (1995), who reported that partial-mouth measurements, conducted in an adult Kenyan population using CPITN, underestimated disease in persons with severe periodontitis. There is more misclassification of disease status using the CPITN index; disease is underestimated in populations with severe disease and overestimated in younger age groups.

This population had fairly heavy calculus deposits when the assessments were made. As a result, the cementoenamel junction was not always visible, making it difficult to assess attachment loss accurately. We could more precisely estimate probing depth and therefore chose this method. Moreover, studies have shown good correlation between probing depth and attachment loss in measuring periodontal disease (Machtei et al. 1993).

We used the mean probing depth rather than the percentage of diseased sites as the preferred method to compare full- and partial-mouth measurements. The precision of estimating the proportion of diseased sites always decreases with smaller samples. Dowsett et al. (2002) found that there was more underestimation of disease in Ramfjord teeth (a maximum of six teeth) as compared with half-mouth (a maximum of 14 teeth). A critique for using the mean is that it is influenced by healthy sites. However, since our population had severe disease in many teeth, this was not likely to lead to substantial measurement error.

This overall high agreement between Ramjford teeth and full-mouth periodontal pocket situation suggests that periodontal assessment using Ramfjord teeth may be a useful alternative to fullmouth measurements in epidemiological studies. These findings are consistent with those of Sicilia et al. (1990), who found that average severity scores of periodontal disease are obtained more accurately with the six Ramfjord teeth than the CPITN index.

The fact that only six instead of 10 teeth (in the CPITN) does imply that more subjects can be examined, making the index a better epidemiological tool in studies involving a large number of subjects and in settings with low number of dental personnel.

We are advocating the use of Ramfjord teeth for periodontal screening in estimating periodontal treatment needs and in making generalizations about whole-mouth periodontal situations.

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Address:

E. G. S. Mumghamba Department of Restorative Dentistry Faculty of Dentistry PO Box 65014 Dar es Salaam Tanzania E-mail: emumghamba@muchs.ac.tz This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.