

Oral Health in Guatemalan Rural Populations

MLADEN M. KUFTINEC

*Massachusetts Institute of Technology, Cambridge, Massachusetts 10239, USA and the
Institute of Nutrition of Central America and Panama, Guatemala City, Guatemala CA*

In three Guatemalan rural populations absence of preventive measures, lack of oral hygiene, and poor diet were associated with severe dental caries. Young subjects with deciduous teeth had a higher incidence of caries than previously reported. Good masticatory functional patterns prevailed.

Oral diseases have been reported to be frequent in the Guatemalan rural population.¹⁻⁴ The dental problems are exaggerated by the gap that exists between the dentists needed and the number available. The majority of smaller villages do not have any dental services, and most of the rural populations lack dental care. In the present study further understanding was sought of the components contributing to the incidence of caries. The periodontal-oral hygiene index was analyzed in detail. Also, an attempt was made in one of the study areas to analyze a functional aspect of occlusion.

Materials and Methods

This report concerns the status of dental health of three Guatemalan rural populations. Two are located along the coast in the Pacific lowlands region. The first, Finca El Salto in Esquintla, is one of the largest fincas of this region and its population is predominantly Ladino.* The second community, Finca El Ingenio in the department of Suchitepequez, is much smaller and less prosperous than El Salto, and workers are primarily of Mayan Indian origin. The third

study region was the community of San Pedro Necta in the department of Huehuetenango, located in the northwest highlands of Guatemala close to the Mexican border. Its population has a large percentage of both Mayan Indians and Ladinos.

Seven-hundred and sixty-seven individuals were examined, who ranged in age from 1 to 75 years with almost an equal number of both sexes. Data were tabulated in age groups corresponding to the predominant type of dentition: 1 to 6 year olds had deciduous dentition, 7 to 12 year olds had mixed dentition, and 13 years and older (80% were 13 to 30) had permanent teeth. Separating the population in this manner permitted correlations between dental decay of deciduous dentition, def (decayed, requiring extraction, filled), and high DMF (decayed, missing, filled) indexes in the permanent dentition.

The examination was conducted under natural light with a dental mirror and explorer while the patient sat in a portable dental chair. Findings were coded for computer analysis as the def-DMF index and a modified DMF surface index. The caries score accounts for the severity of a carious lesion (a mesio-occlusal lesion weighted twice as much as either an occlusal or a smooth surface lesion). An extensive carious lesion affecting most of the crown was given a value of 4, and if the pulp was involved, it was increased to 5. Many retained roots or incompletely resorbed and decayed portions of deciduous teeth were not caused exclusively by caries, but were related to it, so an arbitrary weight of 2 was given to them. Any restorative dental work, besides extraction, was recorded.

Periodontal condition and oral hygiene were combined in one index in previous survey reports of Central America and indi-

This investigation was supported by Grant No. DE 105 from the National Institute of Dental Research, National Institutes of Health, Bethesda, Md. The survey was made possible through the help of the Institute of Nutrition of Central America and Panama.

Received for publication March 2, 1970.

* Ladino is the term used in Guatemala to designate persons who are not culturally identifiable as Indian. It covers a wide range of European-Indian mixtures. It is similar to the term Mestizo used elsewhere in Latin America.

cated mild forms of a dental pathologic condition.^{1,4} Although the periodontal condition and oral hygiene are related closely, they were differentiated to learn which was the greater contributing factor. In the present report, the Russell Periodontal Index was used to evaluate the periodontal condition.⁵

The state of oral hygiene was given subjective judgment by the examiner, by the method described by Green and Vermillion.⁶ A value of 0 was given for good hygiene, and up to 4 to describe increasingly poor hygiene.

The presence of soft debris (ratings from 0 to 3), stain formation (ratings 0 to 2), and dental calculus deposits (ratings 0 to 3) were also evaluated.

Results

The prevalence of dental caries is expressed in terms of both the standard def-DMF index and the caries score (Tables 1-4). Separate calculation of the DMF in-

dexes for the 1 to 6 year olds² was considered irrelevant because the mandibular incisors (usually appearing at 5 years) were the only permanent teeth that had erupted, except occasional maxillary central incisors (usually not appearing before the age of 7). None of these permanent teeth had developed carious lesions.

The def and DMF indexes in the 7 to 12 year age group are separated. The proportion of the two changes from a relatively high def and low DMF, to a low def and high DMF as the subjects approach the upper age limit of the group. Tables 1 to 4 give the averages for each sex, as well as pooled totals.

Table 5 shows the contribution of the smooth surface lesion to the def or DMF. Some of the indexes' value, especially in the 1 to 6 year olds, came from the structural imperfections of the enamel (hypomineralization, Cauqué lesion⁴) but this was not great and, furthermore, the definitive distinction between a carious lesion

TABLE 1
AVERAGE DEF-DMF INDEXES AND CARIES SCORES—EL SALTO

Age Group	Sex	No. of Subjects	def	DMF	Caries Score
1-6	M	45	4.15	...	7.09
	F	50	4.34	...	8.26
	M + F	95	4.25	...	7.69
7-12	M	34	5.02	2.39	13.35
	F	36	4.86	2.20	11.84
	M + F	70	4.94	2.26	12.58
13 up	M	49	...	10.97	14.16
	F	76	...	15.15	16.95
	M + F	125	...	13.06	15.55
Total for all ages (def-DMF)	M	128	7.47		11.53
	F	162	8.79		12.32
	M + F	290	8.14		11.93

TABLE 2
AVERAGE DEF-DMF INDEXES AND CARIES SCORES—EL INGENIO

Age Group	Sex	No. of Subjects	def	DMF	Caries Score
1-6	M	19	3.47	...	5.10
	F	15	4.86	...	5.53
	M + F	34	4.16	...	5.31
7-12	M	22	3.92	3.02	11.04
	F	15	3.43	2.44	6.33
	M + F	37	3.80	2.76	8.68
13 up	M	58	...	11.12	14.01
	F	61	...	13.45	19.26
	M + F	119	...	12.28	16.63
Total for all ages (def-DMF)	M	99	7.47		10.05
	F	91	8.79		10.37
	M + F	190	8.14		10.21

TABLE 7
INDICATORS OF PERIODONTAL HEALTH AND ORAL HYGIENE: PERIODONTAL INDEX (PI), ORAL
HYGIENE (OH), SOFT DEBRIS (SD), STAIN (ST), AND DENTAL CALCULUS (DC)

Age	Sex	El Salto					El Ingenio					San Pedro Necta				
		PI	OH	SD	ST	DC	PI	OH	SD	ST	DC	PI	OH	SD	ST	DC
1-6	M	0.4	0.58	0.33	0.2	0.0	0.8	0.8	0.3	0.1	0.0	0.6	0.9	0.4	0.1	0.0
	F	0.7	0.8	0.4	0.2	0.0	0.8	0.8	0.4	0.0	0.0	0.6	1.0	0.4	0.1	0.0
7-12	M	0.6	1.3	0.7	0.3	0.0	0.6	1.2	0.7	0.4	0.0	0.9	1.2	0.8	0.3	0.0
	F	0.3	1.2	0.5	0.4	0.3	0.4	1.2	0.8	0.3	0.0	1.0	1.5	0.8	0.2	0.0
13 up	M	2.1	1.5	0.3	0.6	1.1	2.2	2.0	0.8	0.8	1.2	1.0	1.7	0.7	0.8	1.0
	F	1.8	1.1	0.4	0.3	0.5	1.3	2.3	0.9	0.7	1.1	1.8	1.9	0.7	0.6	0.7

instances of pharyngitis possibly related to abscesses of mandibular molars were seen.

The results of the gross examination of occlusion, conducted at El Salto on 165 subjects from 1 to 12 years of age, are reported in Table 8.

Discussion

Of the high def and DMF indexes reported for the Central American countries,² Guatemala had the highest rating. The calculated DMF index in the present study was not as high as those reported previously; the def index, however, was. It appears from this and several previous studies, that the high def index is related to the later occurrence of a high DMF index.^{2,4} The increase in the def index suggests that dental caries prevalence is elevated, probably because of high carbohydrate diet patterns and poor oral hygiene.

Although the DMF index was lower than those in previous studies,^{2,4} the inadequate examination facilities, insufficient lighting, and inavailability of radiographs accounted for part of that difference. Also, only 20% of the subjects in the third group were over 30 years of age, when dental health deteriorates more rapidly. Considering this portion of the third group separately, the observed DMF index was about 20.

An important sequel to dental decay is focal infection, which could be related to the frequent occurrence of heart disease, rheumatic fever, and kidney damage in this population.¹

The caries scores (Tables 1-4) illustrate the extent to which lesions appeared. Teeth with probable pulpal involvement were frequent (Table 5), contributing greatly (a value of 5) to the caries score. The smooth surface lesion is considered separately because of its differences in pathogenesis from the pit and fissure lesions.⁷ Calculations made from the data in Table 5 show that the elimination of the smooth surface lesions decreases the def-DMF index by approximately 1, a remarkable effect especially in the 1 to 6 year age group. Good oral hygiene of the youngest age group would accomplish this objective in part and thus modify the prevalence of dental caries.

Table 6 illustrates the small number of inhabitants of the rural regions receiving dental care. Many subjects had their first encounter with a dentist during this study.

TABLE 3
AVERAGE DEF-DMF INDEXES AND CARIES SCORES—SAN PEDRO NECTA

Age Group	Sex	No. of Subjects	def	DMF	Caries Score
1-6	M	19	5.68	...	7.73
	F	30	4.83	...	7.83
	M + F	49	5.25	...	7.78
7-12	M	64	4.24	3.00	12.65
	F	57	3.77	3.41	11.52
	M + F	121	3.89	3.19	12.08
13 up	M	48	...	13.30	16.45
	F	69	...	15.79	19.15
	M + F	117	...	14.55	17.80
Total for all ages (def-DMF)	M	131		8.69	12.28
	F	156		9.22	12.83
	M + F	287		8.95	12.55

TABLE 4
AVERAGES OF TOTAL DEF-DMF INDEXES AND CARIES SCORES—THE THREE LOCATIONS

	def-DMF	Caries Score
El Salto	8.14	11.93
El Ingenio	7.47	10.21
San Pedro Necta	8.95	12.55
Total of the 3 locations	8.19	11.56

and a developmental imperfection is not resolved. The frequency of teeth with apparent pulpal involvement is included in Table 5. The number of restorations and

prosthetic replacements (Table 6) indicates the rare dental service received. The Periodontal Index and data relating to oral hygiene, soft tissue debris, dental calculus, and staining, for the communities by sex and age group are also given (Table 7).

Cauqué lesion was found in 23 individuals, distributed randomly between both sexes in all three communities. Tonsillitis and lymphadenopathy were common. Three abscesses of the submandibular region were observed, all of possible dental origin. Two instances of herpes, one instance of bilateral maxillary suppurative sinusitis, and several

TABLE 5
SMOOTH SURFACE LESIONS (SSL) AND TEETH WITH PULPAL INVOLVEMENT (PI) IN SUBJECTS (N)

Age	Sex	El Salto			El Ingenio			San Pedro Necta		
		N	SSL	PI	N	SSL	PI	N	SSL	PI
1-6	M	45	32	2	19	16	1	19	30	3
	F	50	36	7	15	24	1	30	32	4
	M + F	95	68	9	34	40	2	49	62	7
7-12	M	34	25	13	22	23	6	64	55	23
	F	36	23	11	15	17	1	57	36	19
	M + F	70	48	24	37	40	7	121	91	42
13 up	M	49	55	7	58	65	19	48	46	7
	F	76	74	11	61	88	11	69	68	15
	M + F	125	129	18	119	153	30	117	114	22

TABLE 6
NUMBERS OF RESTORATIONS (RE), AND REMOVABLE REPLACEMENTS (RR), AND FIXED REPLACEMENTS (FR)

Age	Sex	El Salto			El Ingenio			San Pedro Necta		
		RE	RR	FR	RE	RR	FR	RE	RR	FR
1-6	M	...	...	...	...	...	...	...	...	...
	F	...	...	...	...	...	...	...	...	...
7-12	M	1	...	...	...	...	...	...	...	...
	F	3	...	...	...	...	...	...	...	...
13 up	M	4	4	4	...	1	...	24	8	9
	F	24	19	8	...	...	3	34	20	11

TABLE 8
OCCLUSION IN SUBJECTS (N) EXAMINED AT EL SALTO ACCORDING TO ANGLE'S CLASSIFICATION

Sex	N	Neutro-occlusion (normal)	Class I Malocclusion	Class II Malocclusion	Class III Malocclusion	Not Determined
M	79	59 (74.6%)	16 (20.2%)	1 (1.2%)	1 (1.2%)	2 (2.5%)
F	86	66 (76.7%)	14 (16.2%)	3 (3.5%)	3 (3.5%)	...
M + F	165	125 (75.7%)	30 (18.1%)	4 (2.4%)	4 (2.4%)	2 (1.2%)

No dentist had ever visited two of the three locations. The data in Table 6 specify only the number of restorations with no reference to their adequacy or quality, and possible prosthetic replacements. Among these rare services, fixed prosthetic replacements such as partial gold crowns on maxillary incisors had been obtained, not for dental treatment, but, according to the existing custom, as an indication of wealth.

Mild forms of periodontal disease were observed in the two younger age groups. Marginal gingivitis was present in the majority of the subjects. Since little or no rinsing or brushing was practiced, accumulation of soft debris and stain was common. The stain may suggest high consumption of coffee, tea, black beans, and lack of tooth-brushing.

Only limited deposits of dental calculus were observed in spite of the high calcium content of the average diet in the form of lime-treated corn used in preparing tortillas. The phosphorus content of the diet was also high.

The staple foods are relatively rich in carbohydrates including sucrose in different forms, such as an inexpensive raw product of sugar cane (panela). The protein foods that could decrease caries development are not consumed in sufficient quantities.

Thus the oral hygiene is overwhelmingly poor and caries prevalence is high. Unpublished Guatemalan Health Department data indicate that the fluoride content of most water supplies in Guatemala is low, averaging below 0.5 ppm. In some regions no fluoride had been detected. Fluoridating the drinking water would be advantageous.

The incidence of malocclusion is high in civilized man and tends to increase as the level of civilization and culture rises.⁸ In the sample that was studied (Table 8), surprisingly good functional patterns were observed. About 75% of all occlusions were classified as neutro-occlusion and an additional 20% could be added because they

showed only minor symptoms of malocclusion. Therefore, only a small percentage were typical Class II or Class III malocclusions. None could be classified as severe or accompanied by facial characteristics. The only symptom of malocclusion that occurred with significant frequency was the kind referred to as "high canines," presumably developed because of a lack of space for the normal eruption of permanent canines because of the premature loss of the deciduous teeth. With relatively little preventive or corrective orthodontic work all occlusions could be made quite satisfactory.

Conclusions

A survey was conducted of 767 individuals of both sexes and covering a wide age range, from three Guatemalan regions representing the rural lowlands and highlands. The prevalence of carious lesions, expressed both as the def-DMF index and as a caries score, was high, similar to previous reports. It was evident that no form of oral hygiene had been practiced.

No significant difference could be observed between oral health in the lowlands and in the highlands. Furthermore, the difference between the two lowland communities, one more prosperous than the other, was small; the dental caries incidence was actually lower in the poorer region.

Examination of 165 children revealed that the incidence of malocclusion was low and occlusal functional patterns were generally good. The almost total lack of dental services was obvious in all three regions.

Encouragement and advice during the field work were given by N. S. Scrimshaw. The computerized processing of the data and advice in analysis were given by M. Guzmán, chief of the division of statistics at INCAP.

References

1. BÉHAR, M. (ed): *Evaluacion Nutricional de la Poblacion de Centro America y Panama*, ICNND STUDY, INCAP, 1969.

2. CABRERA, I.M.: Salud Oral, in BÉHAR, M. (ed): *Evaluacion Nutricional de la Poblacion de Centro America y Panama*, ICNND STUDY, INCAP, 1969, pp 51-57.
3. LOESCHE, W.J., and HENRY, C.A.: Intracellular Microbial Polysaccharide Production and Dental Caries in a Guatemalan Village, *Arch Oral Biol* **12**:189-194, 1967.
4. SWEENEY, E.A., and GUZMÁN, M.: Oral Conditions in Children from Three Highland Villages in Guatemala, *Arch Oral Biol* **11**:687-698, 1966.
5. RUSSELL, A.L.: A System of Classification and Scoring of Prevalence Surveys of Periodontal Disease, *J Dent Res* **35**:350-359, 1956.
6. GREEN, J.C., and VERMILLION, J.R.: The Oral Hygiene Index: A Method for Classifying Oral Hygiene Status, *JADA* **61**:172-179, 1960.
7. FITZGERALD, R.J., and JORDAN, H.V.: Polysaccharide-Producing Bacteria and Caries, in HARRIS, R.S. (ed): *Art and Science of Dental Caries Research*, New York: Academic Press, 1968, pp 79-86.
8. SALZMANN, J.A.: *Principles of Orthodontics*, Philadelphia: Lippincott Co., 1950.