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Longitudinal periodontometry

EDWARD GREEN, JOSEPH A. CLAYTON, AND MICHAEL A. SCHORK

Division of Periodontology, University of California, San Francisco, California,
Department of Crown and Bridge, University of Michigan, and
University of Michigan School of Public Health, Ann Arbor, Michigan, U.S.A.

The O'Leary-Rudd periodontometry system was modified to facilitate longitudinal studies of horizontal tooth mobility. Repeated measurements of the horizontal tooth mobility of tooth #27 and tooth #28 were accomplished in six patients to determine the accuracy and experimental error of the modified system. The mobility value of each tooth in all six patients was within the previously reported physiologic range of mobility values. The reproducibility or tolerance of the modified system was evaluated by calculating the coefficient of variation of the mobility measurements obtained from the repeated trials. The average coefficient of variation of the measurements within a patient was 11 %. The average coefficient of variation of the measurements between the six patients was 10 %.

Introduction

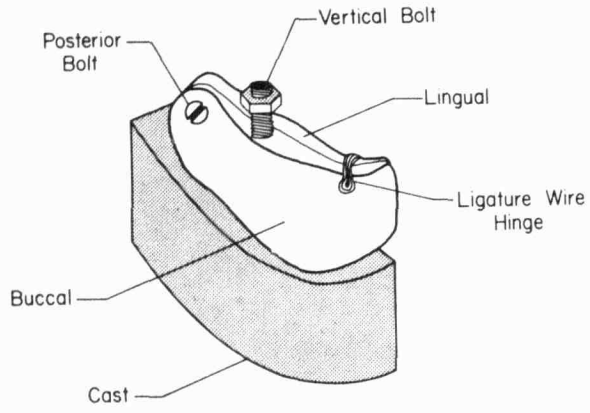
Clinical investigations of horizontal tooth mobility have been hampered by a lack of accurate measurement devices which are easy to use (Mühlemann 1967). The development of the O'Leary-Rudd periodontometer (O'Leary and Rudd 1963) overcame some of the limitations inherent in the earlier Mühlemann mobility measurement devices (Mühlemann 1967 and Mühlemann 1951), but as is indicated by the lack of widespread use of either system, some problems still remain. Mühlemann's macroperiodontometer uses plaster for retention and the O'Leary-Rudd apparatus is similarly retained by intra-oral cementation accomplished with a stone and slurry water mixture. The retention systems of both periodontometers were designed for application of the instruments to a variety of dentitions, which is an important consideration in epidemiological investeigations. Although the technique of using either instrument and the required cementation procedures can be mastered with time and practice, these measurement systems have not been widely used in longitudinal studies.

In this investigation, the O'Leary-Rudd periodontometer system was modified to facilitate longitudinal studies of possible changes in horizontal tooth mobility within specific dentitions. Such longitudinal studies are essential to investigate the long-range effects of different treatment procedures (Greene 1968) and require continuing programs of mobility measurement sessions. The purpose of this paper is to describe these modifications and to report the findings of clinical tests performed with the modified periodontometer.

Material and Methods

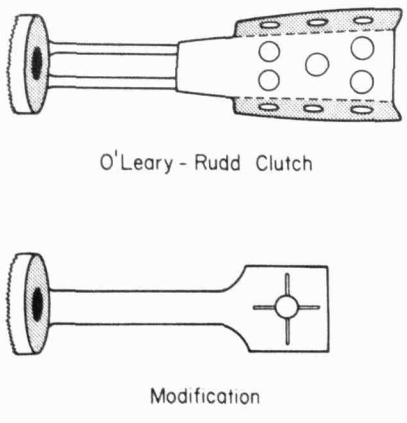
Self-curing acrylic resin (tray type) and a metal casting were used to fabricate a custom clutch for intra-oral attachment of the O'Leary-Rudd periodontometer. The acrylic portion of the clutch consisted of a buccal section and a lingual section. These

FIG. 1



acrylic sections were closely adapted to the three or four most posterior teeth present on casts that duplicated the dentition to be monitored. A hinge made of heavy ligature wire held these sections together anteriorly. The sections were approximated posteriorly by a bolt which passed through the buccal section and engaged a nut secured into the lingual section. Screwing the bolt into the nut joined the two sections tightly together against the teeth and held the clutch securely in position intra-orally. A vertical bolt was fixed into the occlusal portion of one-half of the acrylic clutch. The perforated channel (posterior section) of the original O'Leary-Rudd clutch, designed to contain and lock into the stone cementing medium, was replaced. The anterior knurled portion of the original clutch was duplicated but the metal replacement part terminated with a flat projecting arm containing a single hole located at the intersection of two V-shaped channels. This section could be fixed tightly with a nut to the bolt projecting from the occlusal position of the custom formed acrylic clutch. The acrylic portions of the clutch are shown in Fig. 1. The modified section along with the original clutch portion of the O'Leary-Rudd instrument is shown in Fig. 2.

FIG. 2

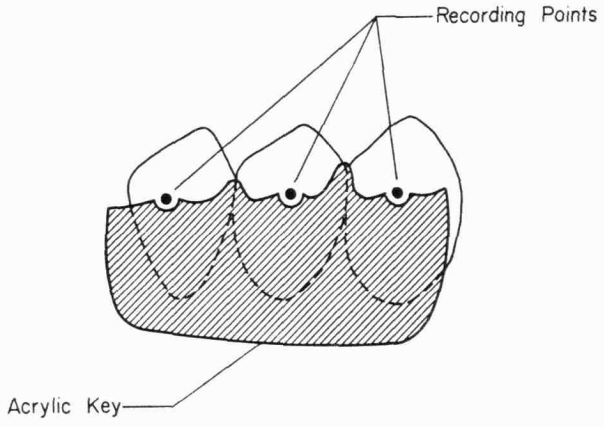


Acrylic keys were made and used to insure duplication of the position of the recording stylus on the tooth being measured. The position for the placement of the recording stylus was marked on the cast in the mesial-distal center of the tooth to be measured at a point 4 mm apical to the occlusal facial or incisal facial line angle. The acrylic keys were formed by painting quick-setting acrylic onto the casts. A small indentation was placed in the key at the predetermined location. These acrylic keys were placed on the patient's isolated dried teeth and a felt tip marker was used to mark and locate the position for each application of the periodontometer stylus. An acrylic key is illustrated in Fig. 3.

Results

Clinical tests were undertaken to assess the reproducibility of results with the modified measurement system as an approach to determining the error inherent in the method. Three young adult patients with complete dentitions and no clinical evidence of periodontal disease underwent repeated tests of the mobility of tooth #27 and tooth #28. On each of the two different occasions five mean mobility values were determined for each of the specified teeth. The periodontometer was assembled using previously constructed custom clutches and

FIG. 3



mean mobility values were determined and recorded for each tooth. Each of these ten means was calculated from a series of eight buccal and eight lingual recordings of horizontal tooth mobility initiated by a 500 gram (pond) force. The clutch was completely removed after each series (eight buccal and eight lingual measurements) and then immediately replaced for the next series of measurements.

The clutch modification described also permits easy application of the periodontometer to incomplete dental arches. Additional tests were conducted of the variability of the system when it was used to measure horizontal tooth mobility of the same teeth (numbers 27 and 28) in three additional patients with incomplete mandibular dentitions.

The results of these repeated measurements in the six patients are summarized in Table I. The average coefficient of variation of the modified system between the six patients was 10 %. The average coefficient of variation of the modified system, within each patient was 11 %. Mobility is expressed in mm/100 in Table I–A.

Discussion

Fabrication of the acrylic portion of the custom clutches is a laboratory procedure which requires approximately 30 minutes per clutch. However, the use of these custom clutches eliminates the time otherwise required for:

1. decanting, preparation and storage of the slurry water generally used to cement the O'Leary-Rudd periodontometer
2. mixing and setting of the cementing medium (a minimum of four minutes is required each time the periodontometer is placed (O'Leary 1966)
3. post-cementation removal of the stone cementing medium particles (which generally requires the use of a scaling instrument and dental floss).

Table I

Measured horizontal tooth mobility (inches $\times 10^{-4}$)

Patient	Tooth # 27			Tooth # 28		
	$\bar{x}$	s	Coef. of Var.	$\bar{x}$	s	Coef. of Var.
H	27.6	2.8	10 %	25.2	1.1	4 %
K	26.6	2.8	11 %	23.1	1.6	7 %
M	29.8	2.5	8 %	19.6	2.8	14 %
B*	26.2	2.5	10 %	23.4	1.6	7 %
C*	22.6	4.0	18 %	22.2	3.6	16 %
R*	21.3	5.3	25 %	23.9	2.5	10 %
Comb. Data	25.7	3.2	12 %	23.1	1.9	8 %

* indicates incomplete mandibular dentition

Table I–A

Measured horizontal tooth mobility $\left(\frac{mm}{100}\right)$

Patient	Tooth # 27			Tooth # 28		
	$\bar{x}$	s	Coef. of Var.	$\bar{x}$	s	Coef. of Var.
H	7.0	.71	10 %	6.40	.28	4 %
K	6.76	.71	11 %	5.87	.41	7 %
M	7.57	.64	8 %	4.98	.71	14 %
B*	6.66	.64	10 %	5.94	.41	7 %
C*	5.74	1.02	18 %	5.64	.91	16 %
R*	5.41	1.35	25 %	6.07	.64	10 %
Comb. Data	6.53	.81	12 %	5.87	.48	8 %

*indicates incomplete mandibular dentition

An extensive period of practice with the O'Leary-Rudd periodontometer has been recommended before clinical experimentation using this instrument is attempted (O'Leary 1966). We have observed that the use of the custom clutches eliminated part of the time required to master the use of the instrument. Time can also be conserved in longitudinal studies because the same clutch can be used repeatedly over the entire period of time of the study.

Only a portion of the variability reported in this study is due to the mechanical aspects of the instrument system. A large part of the error in the periodontometry systems available today is due to human inconsistencies in reading both the force meter dial and the movement indicator dial. The timing of both the force application with the dynamometer and the resultant movement recording are very critical factors (Mühlemann 1967). In order to assure meaningful results, constant attention and precision are required. Four times the number of force applications and readings recommended in the original system (O'Leary and Rudd 1963) were used in the present study to determine each mean measurement. It was felt that this increased number of readings provided a more precise mobility value.

It is obvious that the data on horizontal tooth mobility from one group of observers must be assessed and considered independently of the results reported by others. However, for comparison purposes only, data which has been reported previously (Rudd, O'Leary and Stumpf 1964) by the developers of the O'Leary-Rudd system, is shown in summary with the findings of the present study in Table II. As is indicated in

Table II

Mobility using original and modified systems (inches $\times 10^{-4}$)

	Tooth # 27		Tooth # 28	
	Original System*	Longitudinal Modification	Original System*	Longitudinal Modification
$\bar{x}$ H.T.M.	25.0	25.7	20.6	23.1
Min-Max	11–40	21–30	13–26	19–25

* original data from SAM-TDA –64–12, February 1964

Table II–A

Mobility using original and modified systems $\left(\frac{mm}{100}\right)$

	Tooth # 27		Tooth # 28	
	Original System*	Longitudinal Modification	Original System*	Longitudinal Modification
$\bar{x}$ H.T.M.	6.35	6.53	5.23	5.87
Min-Max	2.79–10.16	5.33–7.62	3.30–6.60	4.83–6.35

* original data from SAM-TDA –64–12, February 1964

Table II, the longitudinal study modification described in this report provided mobility measurements which were in accord with mobility measurements obtained using the original O'Leary-Rudd periodontometry system. Mobility is expressed in mm/100 in Table II-A.

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Address:
Edward Green, DDS, MS
Chairman, Division of Periodontology
School of Dentistry
University of California
San Francisco, California 94122