

[Original] Matsumoto Shigaku 12 : 310~315, 1986

key words : automatic periodontal probe — probing depth — calibrated probe — constant-force — periodontal disease

## Measurement of Pocket Depths Using a New Automatic Constant-Force Probe

NORIO OTA

*Department of periodontology, Matsumoto Dental College  
(Chief : Prof. N. Ota)*

### Summary

Using a new automatic constant-force probe, the author measured the pocket depth for all surfaces in both arches in patients with periodontal disease and clinically healthy students, a total of 27 subjects. The results were as follows :

1. The time required for probing of all surfaces in both arches in the subjects was on the average 6 minutes 39 seconds  $\pm$  56 seconds.
2. The variation in measurements with the automatic probe was not different from that with the calibrated periodontal probe.
3. This new probe provided automatic digital display, print out, and a graph of the pocket depth by simply inserting the tip into the periodontal pocket. It was concluded that it was not necessary to read and record the measurement scale. In addition, It was easy to operate and could measure more accurately and faster than any other probe. This new probe is appropriate for routine clinical use.

### Introduction

The investigation of the periodontal pocket depth, width and topography is extremely important in the diagnosis, treatment, prognosis and treatment reevaluation of periodontal disease. Pocket explorers<sup>1)</sup> and pocket probes<sup>1)</sup> (calibrated periodontal probes), hereafter referred to as probes, have long been used to measure periodontal pockets. By inserting them into the periodontal pocket, the measurement of depth and the probing for gingival bleeding is measured by tactile sense.

Visual reading of a graduated probe has been used for measurement of periodontal pockets. There will be a large margin of error with this method due to the pressure of the probe tip (measurement pressure), direction, shape of the tooth, deposits, and anatomical conditions.

Also this method tends to be subjective and operator skill is required. As a result, there are many defects which take a long time to measure. There has been great demand for a probe which is easy to handle and a measurement method which is quick and accurate.

Recently, a probe has been developed which has fixed measurement pressure (fixed insertion

pressure), an important aspect in the measurement of periodontal pockets.<sup>2-7)</sup> It has been reported that this probe is very effective in measuring periodontal pockets in that it promotes objectivity.

The author had the opportunity of doing clinical trials with the automatic constant-force (measurement pressure) periodontal pocket probe<sup>6,8)</sup> which was developed by J. M. Co. using applied electronics. Comparing results with conventional calibrated probes, interesting discoveries were made. The results are reported below.

### Materials and Methods

#### 1. Sample group :

Twenty-seven subjects were chosen as the sample group. They included 15 out-patients of the department of periodontics of Matsumoto Dental college who had periodontal disease, and 12 students having clinically healthy gingiva.

#### 2. Periodontal pocket measurement methods

-Instruments :

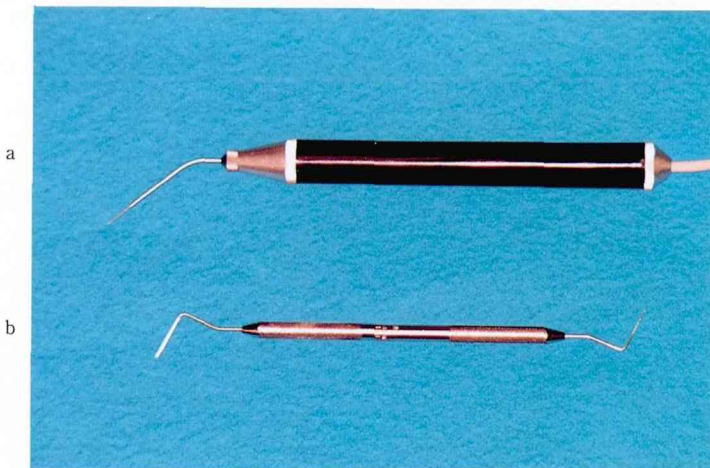
Calibrated periodontal pocket probe<sup>1)</sup> (hereafter referred to as manual probe) and the constant-force (measurement pressure  $25 \pm 5$  g) automatic periodontal pocket probe (hereafter referred to as the Probie)<sup>6,8)</sup> were used. (Fig. 1)

#### 3. Methods :

The area was gently washed and dried for 5 seconds in a dry field. Periodontal pocket measurements were done at six points (mesial, center, and distal on the labial and lingual surfaces) for all of the teeth in both arches. Alternatively, the 4-point measurement method could have been used.

#### (1) Comparison of measurement values using the manual probe and the automatic probe :

Three points each on the labial and lingual surfaces of 11 were measured in 27 subjects (54 teeth) and the average was recorded as the pocket value. Next, The author looked into the variation



**Fig. 1.** Periodontal probe used measurement of pocket depths  
 a : Automatic constant-force periodontal pocket probe (probie)  
 b : Calibrated periodontal pocket probe (G. F./W. DE type)

of the pocket values which were measured by these two types of probes. Differences were investigated by dividing the depths of the periodontal pockets into 3 stages (0-2 mm, 2-4 mm, >4 mm).

(2) Comparison of the measurement times using the two probes:

Probing depths of both maxilla and mandible were measured on 10 patients.

### Results

1. A comparison of measurement values using the manual and the automatic probes:

Table 1 shows the values for the pocket measurements made using the two types of probes at a total of 6 points on the labial and palatal surfaces of  $\overline{111}$  in 27 subjects (54 teeth).

It was on the average  $2.7 \pm 1.4$  mm using a manual probe and  $2.5 \pm 1.3$  mm using an automatic probe. No significant difference could be found between those two types of probes.

Next, the author examined the variation in the measurement values using these two probes by dividing the periodontal pockets into 3 stages (0-2 mm, 2-4 mm, >4 mm). The variation between measurements using the two types of probes was investigated (Table 2). There was no difference variation for the two types of probes regardless of pocket depth.

2. Table 3 indicates the time required to measure all the pockets in both arches for 10 patients using the two types of probes. Examination of the pockets was done by 5 examiners of varying experience, including students and hygienists having limited experience, and periodontists with more than three years of practice. Inspection using the two-way layout method showed a significant decrease in probing time with the Probie compared to the manual probe ( $p < 0.01$ ). (Table 4)

There was also a significant correlation between the examiner's experience and probing time ( $p < 0.01$ ). Therefore, the time required for measurement with an automatic probe is clearly shorter than that for the manual probe, and is much faster when operated by an experienced examiner.

**Table 1.** Mean values and standard deviation and coefficient of variation for the pocket measurements on the labial and palatal surfaces ( $\overline{111}$ )

Tooth Number	Region	Mean $\pm$ S. D.		Var. coef.	
		Automatic probe	Calibrated probe	Automatic probe	Calibrated probe
54	Labial	$2.60 \pm 1.67$	$2.60 \pm 1.33$	0.64	0.51
54	Palatal	$2.36 \pm 1.35$	$2.84 \pm 1.83$	0.57	0.64
	Total	$2.48 \pm 1.33$	$2.72 \pm 1.39$	0.54	0.51

Calibrated (manual) probe

**Table 2.** Mean values and standard deviation and coefficient of variation in the measurement values using two probes by dividing the pocket depths into 3 stages

Probing depth	Number	Mean $\pm$ S. D.		Var. coef.	
		Automatic probe	Calibrated probe	Automatic probe	Calibrated probe
0 - 2.0 mm	31	$1.72 \pm 0.58$	$1.94 \pm 0.67$	0.34	0.35
2.0 - 4.0 mm	13	$2.75 \pm 1.03$	$2.96 \pm 0.87$	0.38	0.29
4.0 mm -	10	$4.50 \pm 1.10$	$4.81 \pm 1.31$	0.24	0.27
Total Mean $\pm$ S.D.	54	$2.48 \pm 1.33$	$2.72 \pm 1.39$	0.54	0.51

### Discussion

Measuring periodontal pockets correctly is extremely important in the treatment and prevention of periodontal disease. Currently, measurement by tactile sense using a pocket explorer<sup>1)</sup> or calibrated periodontal probe<sup>2)</sup> is the common method. However, it is subjective and skill is required. In addition, the probe could not be read at more accuracy than  $\pm 0.5$  mm. Therefore, a method having fixed measurement conditions and more objectivity was considered. Performing measurements by inserting the probe into the pocket with a fixed-pressure of 20-25 g at the tip is effective and promotes objectivity in probing and measurement of the periodontal pocket.<sup>2-7)</sup>

The probe used by the author here, the Probie,<sup>8)</sup> which has an error of less than 0.2 mm, has eliminated many of the measurement errors of other probes. The probe tip is inserted into the periodontal pocket with a constant measurement pressure and, after its springloaded tip reaches the bottom of the pocket, it automatically measures the depth. This automatic probe and a manual probe were used for measurement of the labial and palatal pockets in 1|1, a total of 54 teeth.

Comparison of the pocket measurement values for both probes showed little variation regardless of pocket depth. Neither probe is considered more accurate. The automatic probe is thought to

**Table 3.** The time required for measurement of the pocket depths probed by 3 groups of investigators (6 points on each tooth, Total 32 teeth)

Subjects	Clinical student		Hygienist		Periodontist	
	Calibrated probe	Automatic probe	Calibrated probe	Automatic probe	Calibrated probe	Automatic probe
	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.
1	16 00	13 00	10 24	8 40	6 26	5 35
2	14 21	10 37	9 32	7 44	6 20	5 40
3	14 00	16 27	12 08	8 08	6 17	5 46
4	12 25	10 58	13 32	8 53	5 38	7 55
5	13 30	10 45	7 58	7 38	8 09	6 40
6	12 35	8 33	8 44	8 30	8 38	7 14
7	11 20	9 33	9 38	8 56	7 30	7 00
8	11 55	6 15	8 16	7 35	5 40	5 40
9	13 50	11 53	12 10	8 15	8 00	8 00
10	15 20	12 53	10 14	8 25	7 30	7 00
Mean ± S. D.	13min. 31sec. ± 1min. 29.2sec.	11 min. 5.3 sec. ± 2 min. 45 sec.	10min. 21.6sec. ± 1 min. 52 sec.	8min. 16.4sec. ± 0min. 29.9sec.	7min. 00sec. ± 1min. 4.5sec.	6min. 39sec. ± 0 min. 56 sec.

**Table 4.** Analysis of variance table  
(Two-way layout)

Variance source	df	SS	MS	F
Method	A	2 1.082×10 <sup>6</sup>	5.414×10 <sup>5</sup>	57.68**
Subjects	B	1 1.432×10 <sup>5</sup>	1.433×10 <sup>5</sup>	15.27**
Interaction	A×B	2 4.434×10 <sup>5</sup>	2.217×10 <sup>4</sup>	2.36

54 5.068×10<sup>5</sup> 9.386×10<sup>3</sup>

\*\* F (2, 54, 0.01)=5.021

be better since there is no need to read or record values, and it is easy to handle. Also, it is more objective, more precise and faster. However, any good method is impractical if the measurement time takes too long. The measurement of pocket depths at six points on all teeth in both arches took 22-25 minutes with the manual probe and visual reading.<sup>1,6)</sup>

The Japanese Association of Periodontology reported that it took about 19.3 min. per oral cavity (number of teeth not reported).<sup>9)</sup>

The author found that it took a little less than 7 min. with a probe and a little less than 8 min. with an automatic probe to measure 6 points on all teeth in both arches. Though it took approximately 2 minutes longer on the average, the automatic probe has the advantages of ease of measurement and the lack of necessity of recording the values.

### Conclusion

Using a new constant-force automatic periodontal pocket probe, the author examined the pocket depth of 54 teeth (1|1) of 27 subjects including periodontal patients and students having clinically healthy gingiva. Also, the time required for probing the pockets of every tooth in both arches of 10 periodontal patients were examined. The results were as follows :

- 1) The time required for measurement of the pocket depths in both arches was on the average 6 min. 39 sec.  $\pm$  56 sec.
- 2) The automatic probe (Probie) had less variation in the periodontal pocket measurement values than the manual probe. Also, it was easy to use.
- 3) The automatic probe had some special features. It measured pocket depths automatically, output a digital display, printed values, and made a graph. Compared with the manual probe, the Probie was, convenient in that it did not require the operator to read the scale or record readings. It also had the advantage of measuring more objectively, more accurately, and more efficiently than any other type of probe.

Therefore it can be considered an extremely effective pocket probe for daily clinical use.

### Acknowledgment

I would like to express my appreciation to the staff of the department of periodontics of Matsumoto Dental College.

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