

## Original Research

### Comparison of true pressure sensitive probe and colour coded polymeric probe in measurement of clinical attachment levels

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#### ABSTRACT

Presenting the periodontal probe is the only available, simple yet accurate and dependable method for providing information to locate, assess and measure sulci or pocket. The use of periodontal probe in estimating probing depth is subject to large errors. Hence, one method or reducing errors in probing depth assessment is to employ a probe capable of providing a standard probing force, so in the present study a clinical evaluation and comparison made to know the effect of controlled probing over the uncontrolled force in probing depth measurements. **Aims and objectives:** To clinically evaluate and compare color-coded polymeric periodontal probe (Periowise-1st generation) with True Pressure Sensitive Probe (TPS-Ivoclar-Vivadent-2nd Generation) in assessment of probing depth measurement in <5mm and ≥5mm probing sites/pockets. **Materials and methods:** **Group A:** Consisted of 20 subjects, each with one shallow (<5mm) and one deep (≥5mm) periodontal pockets/probing sites. The pocket depths were assessed by using both the true pressure sensitive probe and Periowise color-coded polymeric periodontal probe by a single examiner. **Group B:** Consisted of 20 subjects, each with one shallow (<5mm) and one deep (≥5mm) periodontal pockets/probing sites. The pocket depths were assessed by using both the True pressure sensitive probe and Periowise color-coded polymeric periodontal probe by two different examiners (1&2). **Results and Conclusion:** Based on the observation of evaluation and comparison it can be concluded that probe with no attempt to control probing pressure showed a significant deeper recordings both at shallow and deep pocket, and as the probing sites got deeper the differences were more and frequency of agreement between the examiners reduced as the pocket depth increased.

**Key words:** True Pressure Sensitive Probe, Color-coded polymeric probe, inter-examiner reliability.

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#### INTRODUCTION

Periodontal probing is of relevance, because it permits the dentist to identify the site with a history of periodontal disease or at risk for periodontal breakdown and therefore periodontal pocket examination should be accurate technically simple and quick. Presenting the periodontal probe is the only available, simple yet accurate and dependable method for providing information to locate, assess and measure sulci or pocket. In the presence of inflammation, the probe tip frequently penetrates the junctional epithelium, stopping then the most coronal intact gingival fibers are reached, but in health the probe tip usually fails to penetrate the junctional epithelium.

A number of factors other than inflammatory state of the gingiva may influence while estimating the probing depth and clinical attachment level like diameter of the probe tip, angulation, position, errors in visual assessment, patient co-operation, rounding of probe reading, variations in probe markings, probing force, root anatomy, examiner experience and reliability.

#### AIMS AND OBJECTIVES

To clinically evaluate and compare color coded polymeric periodontal probe (Periowise-1<sup>st</sup> generation) with True Pressure Sensitive probe (TPS-ivoclar-vivadent-2<sup>nd</sup> generation) in assessment of probing depth measurement in <5MM (shallow) and ≥5MM (deep) periodontal pockets.

## MATERIALS AND METHODS

A total of 40 subjects with moderate to severe periodontitis were selected from the OPD, department of periodontics, bapuji dental college and hospital, davangere, Karnataka state.

### Selection criteria

Subjects with the following criteria were selected:

1. Subjects within the age group of 21-65 years with moderate to severe periodontitis.
2. subject with two probable sites of shallow pocket and deep pocket were selected in relation to midfacial and vestibular inter proximal surfaces of the first and second molars.
3. Third molars were excluded from the study, because of inaccessibility in those areas.

### Materials

Periowise Color Coded Polymeric Probe -1<sup>st</sup> Generation (Premier Dental Products, USA) with

1. 0.5mm tip diameter.
2. Markings at 3,6,9 and 12mm (#9006104) Each
3. Probes Were Modified with circumferential marking marked at 1mm intervals(fig1,2).

### True pressure sensitive probe-2<sup>nd</sup> generation ( ivoclar-vivadent-USA)(fig 2)

1. Standardized size-0.5mm ball tip to rest against delicate periodontal fibers and minimize tissue trauma.
2. Uniform force: a simple mechanism which allows the operator to observe and control the pressure exerted on the probe tip and to observe the tissue reaction to that force. The force indicator lines coincide at approximately 20 grams force.
3. Probe tips: disposable plastic tips were used in the study, with the markings at 1mm intervals from 1.5mm to 11.5 mm. The pocket depths were recorded to the nearest millimeter.

### Probing technique

The selected cases were subjected to scaling procedures one week prior to the comparison (fig 7). Probing pocket depth with both the probes were measures with the probe tip parallel to the long axis of the tooth (fig 3, 4). In case of TPS probe, the measurements were recorded after the two lines on the tip of the shank coincided (fig 5,6). Customized occlusal stent with vertical groove was used as a guideline to standardize the position and direction of the periodontal probe.

### Method of assessment of probing depths

#### Group A

The selected probing sites ( $\geq 5$ mm and  $< 5$ mm) were assessed randomly by using the TPS probe. Later on the same selected sites were assessed by using periowise CCPP. A time interval of 15 minutes between the inter probe measurements was maintained in order to prevent

bias due to examiner memory as much as possible. All the measurements were carried by a single examiner.

#### Group B

The two different examiners (1&2) assessed the selected probing sites ( $< 5$ mm and  $\geq 5$ mm) by using TPS probe and Periowise CCPP. Examiner 1 assessed the selected probing sites first with TPS probe followed by Periowise CCPP, whereas Examiner 2 assessed the same selected probing sites first with periowise CCPP followed TPS probe.

A time interval of 15 minutes between inter- probe and 45 minutes time interval between inter-examiner measurements was maintained. All the values of Group-A and Group-B for TPS and Periowise CCPP were entered in the standard proforma drawn for this study and subjected to the following statistical analysis.

1. Students paired "t" test was used for comparing the means of two probes.
2. Unpaired "t" test for two independent groups ( $< 5$ mm and  $\geq 5$ mm) probing sites.
3. Repeated measure ANOVA test was used to measure the inter-examiners reliability.

## RESULTS

A total of 40 systemically healthy subjects aged between 21-65 years with moderate to severe periodontitis were selected. In each subject with two probing sites of shallow ( $< 5$ mm) pocket/probing site and deep ( $\geq 5$ mm) pocket/probing site in relation to midfacial and vestibular interproximal surface of first and second molars were selected.

### Clinical observations

#### Group A study (comparison of TPS probe and Periowise CCPP in $< 5$ mm and $\geq 5$ mm probing sites by single examiner)

Twenty selected subjects were subjected to pocket depth measurements(table 1) with TPS probe and Periowise CCPP by single examiner

#### Group B study (comparison of TPS probe and Periowise CCPP in $< 5$ mm and $\geq 5$ mm probing sites by two different examiners)

Twenty selected subjects were subjected to pocket depth measurements (table 4) with TPS probe and Periowise CCPP by two different examiners.

#### Group A study

#### Group A study (comparison of TPS probe and Periowise CCPP in $< 5$ mm and $\geq 5$ mm probing sites by single examiner) table 2

#### Probing sites at $< 5$ mm:

The mean probing pocket depth obtained by TPS probe and Periowise CCPP was  $3.30 \pm 0.52$ mm and  $3.85 \pm 0.59$ mm respectively. On comparison the periowise CCPP showed higher value of  $0.55 \pm 0.22$ mm, which was statically highly significant ( $P < 0.001$ ).

**Probing sites at  $\geq 5\text{mm}$ :**

The mean probing pocket depth obtained by TPS probe and Periowise CCPP was  $7.15 \pm 1.31\text{mm}$  and  $8.00 \pm 0.52\text{mm}$  respectively. On comparison the periowise CCPP showed higher value of  $0.85 \pm 0.49\text{mm}$ , which was statically highly significant ( $P < 0.001$ ).

**Comparison of mean differences between TPS probe and Periowise CCPP in  $< 5\text{mm}$  and  $\geq 5\text{mm}$  probing sites (table 3)**

The mean differences obtained between the TPS probe and Periowise CCPP in shallow ( $< 5\text{mm}$ ) and deep ( $\geq 5\text{mm}$ ) probing sites, showed a higher mean differences in deeper probing sites of about  $0.85 \pm 0.49\text{mm}$  than to shallower probing sites, which showed an mean difference of  $0.55 \pm 0.22\text{mm}$ . The difference obtained was statistically significant ( $P < 0.05$ ).

**Group B study (comparison of TPS probe and Periowise CCPP in  $< 5\text{mm}$  and  $\geq 5\text{mm}$  probing sites by two different examiners) table 4**

**Examiner 1**

**Probing sites at  $< 5\text{mm}$ :**

The mean probing pocket depth obtained by TPS probe and Periowise CCPP was  $2.95 \pm 0.51\text{mm}$  and  $3.50 \pm 0.61\text{mm}$  respectively. On comparison the periowise CCPP showed higher value of  $0.55 \pm 0.22\text{mm}$ , which was statically highly significant ( $P < 0.001$ ).

**Probing sites at  $\geq 5\text{mm}$ :**

The mean probing pocket depth obtained by TPS probe and Periowise CCPP was  $6.90 \pm 1.14\text{mm}$  and  $7.70 \pm 1.42\text{mm}$  respectively. On comparison the periowise CCPP showed higher value of  $0.80 \pm 0.66\text{mm}$ , which was statically highly significant ( $P < 0.001$ ).

**Examiner 2**

**Probing sites at  $< 5\text{mm}$ :**

The mean probing pocket depth obtained by Periowise CCPP and TPS probe was  $3.55 \pm 0.60\text{mm}$  and  $3.10 \pm 0.82\text{mm}$  respectively. On comparison the periowise CCPP showed higher value of  $0.45 \pm 0.39\text{mm}$ , which was statically highly significant ( $P < 0.001$ ).

**Probing sites at  $\geq 5\text{mm}$ :**

The mean probing pocket depth obtained by Periowise CCPP and TPS probe was  $7.80 \pm 1.36\text{mm}$  and  $6.75 \pm 1.12\text{mm}$  respectively. On comparison the periowise CCPP showed higher value of  $1.05 \pm 0.76\text{mm}$ , which was statically highly significant ( $P < 0.001$ ).

**Inter-examiners reliability (table 5)**

**TPS probe**

**Probing sites at  $< 5\text{mm}$ :**

The mean probing pocket depth obtained by the examiner 1 and 2 with TPS probe were  $2.95 \pm 0.51\text{mm}$  and  $3.10 \pm 0.82\text{mm}$  respectively, which showed the differences

of  $-0.15 \pm 0.59\text{mm}$  with the “P” value of 0.49 mm, which was statically not significant.

**Probing sites at  $\geq 5\text{mm}$ :**

The mean probing pocket depth obtained by the examiner 1 and 2 with TPS probe were  $6.90 \pm 1.14\text{mm}$  and  $6.75 \pm 1.12\text{mm}$  respectively, which showed the differences of  $0.15 \pm 0.93\text{mm}$  with the “P” value of 0.68 mm, which was statically not significant.

**Periowise CCPP**

**Probing sites at  $< 5\text{mm}$ :**

The mean probing pocket depth obtained by the examiner 1 and 2 with periowise CCPP were  $3.50 \pm 0.61\text{mm}$  and  $3.55 \pm 0.60\text{mm}$  respectively, which showed the differences of  $-0.05 \pm 0.22\text{mm}$  with the “P” value of 0.80 mm, which was statically not significant.

**Probing sites at  $\geq 5\text{mm}$ :**

The mean probing pocket depth obtained by the examiner 1 and 2 with Periowise CCPP were  $7.70 \pm 1.42\text{mm}$  and  $7.80 \pm 1.36\text{mm}$  respectively, which showed the differences of  $-0.10 \pm 0.97\text{mm}$  with the “P” value of 0.82 mm, which was statically not significant.

**Frequency of agreement between the Periowise CCPP and TPS probe and examiner  $< 5\text{mm}$  and  $\geq 5\text{mm}$  probing sites (Table 6)**

**Probing sites at  $< 5\text{mm}$**

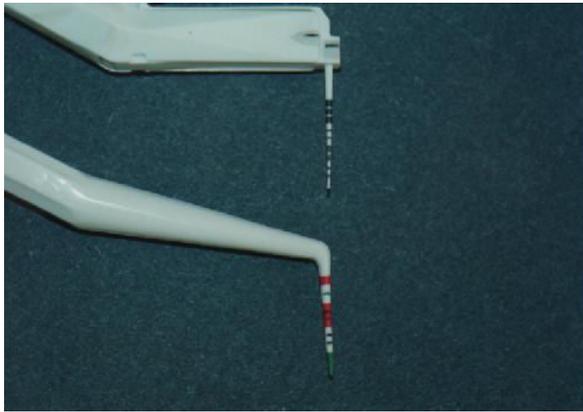
Both the examiners 1 and 2 showed the variation of within  $\leq 0.5\text{mm}$  in 95% of study sites and more than  $> 0.5\text{mm}$  variation in 5% of study sites on probing depth measurement by using two probing techniques at  $< 5\text{mm}$  probing sites.

**Probing sites at  $\geq 5\text{mm}$**

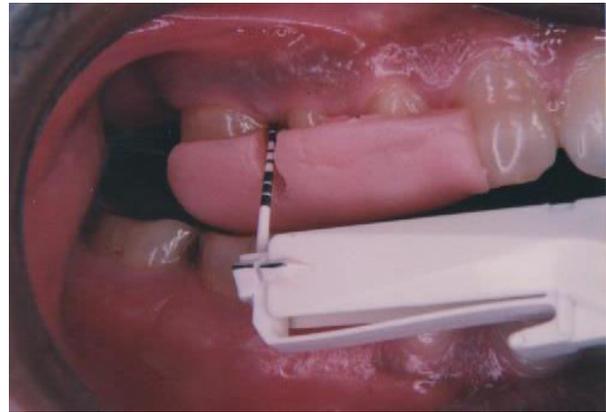
Examiners 1 and 2 showed the variation of within  $\leq 0.5\text{mm}$  in 70% and 60% of study sites and more than  $> 0.5\text{mm}$  variation in 30% and 40% of study sites respectively, on probing depth measurement by using two probing techniques at  $\geq 5\text{mm}$  probing sites.



**FIGURE-1 PERIOWISE COLOR-CODED POLYMERIC PROBE-1ST GENERATION**



**FIGURE-2** TRUE PRESSURE SENSITIVE PROBE AND PERIOWISE COLOR CODED POLYMERIC PROBE



**FIGURE-5** TRUE PRESSURE SENSITIVE PROBE DEPICTING (<5MM) POCKET OR PROBING SITE



**FIGURE-3** PERIOWISE CCPP DEPICTING (<5MM) POCKET OR PROBING SITE



**FIGURE-6** TRUE PRESSURE SENSITIVE PROBE DEPICTING (≥5MM) POCKET OR PROBING SITE



**FIGURE-4** PERIOWISE CCPP DEPICTING (≥5MM) POCKET OR PROBING SITE



**FIGURE-7** ARMAMENTARIUM

**GROUP A STUDY**

PROBING DEPTH MEASUREMENTS OBTAINED AT <5MM AND ≥5MM PROBING SITES WITH TPS PROBE AND PERIOWISE CCPP BY SINGLE EXAMINER (TABLE 1)

	<5mm			≥5mm		
	TPS	Periowise	Difference	TPS	Periowise	Difference
1	2.5	3	0.5	6.5	7	0.5
2	3.5	4	0.5	8.5	10	1.5
3	2.5	3	0.5	8.5	9	0.5
4	3.5	4	0.5	6.5	7	0.5
5	4.5	5	0.5	8.5	10	1.5
6	2.5	3	0.5	9.5	10	0.5
7	3.5	4	0.5	6.5	7	0.5
8	3.5	4	0.5	7.5	9	1.5
9	2.5	3	0.5	7.5	9	1.5
10	3.5	5	1.5	6.5	7	0.5
11	3.5	4	0.5	5.5	6	0.5
12	3.5	4	0.5	5.5	7	1.5
13	3.5	4	0.5	6.5	7	0.5
14	3.5	4	0.5	8.5	10	1.5
15	3.5	4	0.5	5.5	6	0.5
16	3.5	4	0.5	5.5	6	0.5
17	3.5	4	0.5	7.5	9	1.5
18	2.5	3	0.5	8.5	9	0.5
19	3.5	4	0.5	8.5	9	0.5
20	3.5	4	0.5	5.5	6	0.5
<b>X±Sd</b>	<b>3.30±0.52</b>	<b>3.85±0.59</b>	<b>0.55±0.22</b>	<b>7.15±1.31</b>	<b>8.00±1.52</b>	<b>0.85±0.49</b>

COMPARISON OF MEAN PROBING POCKET DEPTH OBTAINED BY TPS PROBE AND PERIOWISE CCPP IN <5MM AND ≥5MM PROBING SITES BY SINGLE EXAMINER (TABLE 2)

Probing depth	Mean ±SD			t-value*	P-level
	TPS	Periowise	Difference		
<5mm	3.30±0.52	3.85±0.59	0.55±0.22	11.00	<0.001
≥5mm	7.15±1.31	8.00±1.52	0.85±0.59	7.77	<0.001

\*=paired t - test

COMPARISON OF MEAN DIFFERENCES BETWEEN TPS PROBE AND PERIOWISE CCPP IN <5MM AND ≥5MM PROBING SITES (TABLE 3)

	<5mm	≥5mm
<b>Mean difference</b>	<b>0.55</b>	<b>0.85</b>
<b>Sd</b>	<b>0.22</b>	<b>0.49</b>
<b>N</b>	<b>20</b>	<b>20</b>

Calculated t-value (2.49) more than table value (2.02)

P<0.05 SIG

**GROUP B STUDY**

COMPARISON OF MEAN PROBING POCKET DEPTH OBTAINED BY TPS PROBE AND PERIOWISE CCPP IN <5MM AND ≥5MM PROBING SITES BY TWO DIFFERENT EXAMINERS (TABLE 4)

Examiners	Probing depths	Mean±SD			t-value*	P-level
		TPS	Periowise	difference		
Examiner 1	<5mm	2.95±0.51	3.50±0.61	0.55±0.22	11.00	<0.001
	≥5mm	6.90±1.14	7.70±1.42	0.80±0.66	5.45	<0.001
Examiner 2	<5mm	3.10±0.82	3.55±0.60	0.45±0.39	5.11	<0.001
	≥5mm	6.75±1.12	7.80±1.36	1.05±0.76	6.19	<0.001

\*=PAIRED T-TEST

INTER EXAMINERS RELIABILITY (TABLE 5)

POCKET DEPTH	EXAMINERS	TPS	PERIOWISE
<5MM	EXAMINER 1	2.95±0.51	3.50±0.61
	EXAMINER 2	3.10±0.82	3.55±0.60
	DIFFERENCE	-0.15±0.59	-0.05±0.22
	P-VALUE*	0.49NS	0.80 NS
≥5MM	EXAMINER 1	6.90±1.14	7.70±1.42
	EXAMINER 2	6.75±1.12	7.80±1.36
	DIFFERENCE	0.15±0.93	-0.10±0.97
	P-VALUE*	0.68 NS	0.82NS

\*repeated measure ANOVA

FREQUENCY OF AGREEMENT BETWEEN THE PERIOWISE CCPP AND TPS PROBE AND EXAMINERS AT <5MM AND ≥5MM PROBING SITES (TABLE 6)

AGREEMENT CRITERIA	TPS v/s PERIOWISE	
	<5MM	≥5MM
PERCENTAGE OF PAIRED PERIODONTAL SITES MEASUREMENTS WITHIN <0.5MM	95% (EXAMINER 1) 95%(EXAMINER 2)	70% (EXAMINER 1) 60%(EXAMINER 2)
PERCENTAGE OF PAIRED PERIODONTAL SITES MEASUREMENTS WITHIN >0.5MM	5% (EXAMINER 1) 5%(EXAMINER 2)	30% (EXAMINER 1) 40%(EXAMINER 2)

**DISCUSSION**

**Group A study (comparison of TPS probe and Periowise CCPP in <5mm and ≥5mm probing sites by single examiner)**

The mean probing pocket depth obtained at both <5mm and ≥5mm probing sites with TPS and Periowise CCPP, revealed that Periowise CCPP showed higher mean

difference on comparison, which was statically highly significant (P<0.001)

These observations were similar with the observations of the studies made by Osborn, et al (1990)<sup>1</sup>, Rams & Slots (1993)<sup>2</sup>, Perry & Co-workers (1994)<sup>3</sup> and Breen, et al (1997)<sup>4</sup> who observed that pocket probing with conventional probe often resulted in deeper recording when compared to the pressure probe.

### **Comparison of mean differences between TPS probe and Periowise CCPP in <5mm and ≥5mm probing sites**

The mean difference obtained between the TPS probe and Periowise CCPP in shallow (<5mm) and deep (≥5mm) probing sites showed a higher mean difference between the probes in deeper probing sites on comparison, which was statically significant ( $P < 0.005$ ).

These observations were similar with the observations of the studies made by vander Velden & devries (1978,80)<sup>5,6</sup>, Goodson, et al (1982)<sup>7</sup>. Badersten & Co-workers (1984)<sup>8</sup>, Kalkwarf & Co-workers (1986)<sup>9</sup>, Jansen & Co-workers (1988)<sup>10</sup>, Epseland, et al (1991)<sup>11</sup> and Rams & Slots (1993)<sup>2</sup> who observed less reproducible probing depth measurements with increasing probing depth.

### **Group B study (comparison of mean probing pocket depth obtained by TPS probe and Periowise CCPP in <5mm and ≥5mm probing sites by two different examiners).**

The mean probing pocket depth obtained at both <5mm and ≥5mm probing sites with TPS and Periowise CCPP by two different examiners, revealed that Periowise CCPP showed higher mean difference on comparison, which was statically highly significant ( $P < 0.001$ ).

The observations also revealed that, examiner 1 tended to score, higher mean difference at <5mm sites, whereas the examiner 2 scored higher mean difference at ≥5mm probing sites.

These observation were similar to the observation of the studies made by Walsh & Saxby (1989)<sup>12</sup>, Quirnen, et al(1993)<sup>13</sup> and Mayfield, et al (1996)<sup>14</sup> who observed that, one examiner tended to under score, while the other examiner over scored on probing depth measurements.

### **Inter-Examiners reliability**

The mean probing pocket depth obtained with TPS probe and Periowise CCPP by two different examiners showed a negligible difference between the examiners, when they used same probes at <5mm and ≥5mm probing sites. The obtained difference was statically not significant.

### **Frequency of agreement between the Periowise CCPP and TPS probe and Examiners at <5mm and ≥5mm probing sites**

In probing at <5mm pockets sites by both the examiner showed the variation of within ≤0.5mm in 95% of study sites and more than >0.5mm variation in 5% of study sites. In probing at ≥5mm probing sites examiner (1&2) showed the variation of within ≤0.5mm in 70% and 60% of study sites and more than >0.5mm variation in 30% and 40% of study sites respectively.

Thus indicating lower/reduced level of agreement between the examiners and probes, as the probing depth increased. These observation were similar to the observations of the studies made by Kalkwarf & Co-workers (1986)<sup>9</sup> who

observed the percentage of match between the two method declined as the probing depth increased and Fleiss, et al (1991)<sup>15</sup> who observed greater the destruction, the greater the disagreement within and between the examiners.

### **Summary and conclusion**

1. Color-coded polymeric probe (Periowise – 1<sup>st</sup>-generation) with no attempt to control the probing pressure/force showed a significant deeper recording at both shallow (<5mm) and deep (≥5mm) probing sites.
2. The mean differences obtained between the TPS and Periowise CCPP at both <5mm and ≥5mm probing sites, showed greater and statically significant mean difference between the probes in deeper sites, thus indicating greater the variability as the probing depth increased.
3. It was confirmed that TPS and Periowise CCPP were the reliable tools when the examiners used the same tool at both <5mm and ≥5mm probing sites.
4. The frequency of agreement between the examiners reduced as the probing pocket depth increased.
5. In future further research studies are required to improve the predictability and reliability of the observations made in the current study.

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