10.5005/jp-journals-10039-1040

ORIGINAL RESEARCH

Comparison of Precision of Three Manual Periodontal Probes on Periodontal Measurements

[1]Garima Singh, [2]Hirak S Bhattacharya, [3]Sidharth Shankar, [4]Kausar Parwez Khan, [5]Smriti Saxena

ABSTRACT

The periodontal probe is an important tool in the diagnosis of presence and severity of periodontal disease, and in the assessment of periodontal treatment. The present study was done with aim to compare the relative accuracy and precision of three different manual periodontal probes: (a) William's periodontal probe, (b) University of North Carolina (UNC)-15 probe and (c) community periodontal index of treatment needs (CPITNs) probe. Periodontal measurements were taken on 10 patients on three index teeth per quadrant on six sites. Results comparing measurements between William's and UNC-15 probe were statistically insignificant. While comparing, measurements of William's and UNC-15 with CPITIN were statistically significant, indicating more bias and variation with CPITN.

Keywords: Periodontal probe, Angulation, Probing pocket depth, Clinical attachment level.

How to cite this article: Singh G, Bhattacharya HS, Shankar S, Khan KP, Saxena S. Comparison of Precision of Three Manual Periodontal Probes on Periodontal Measurements. J Dent Sci Oral Rehab 2014;5(4):177-180.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Periodontal probing is the most useful diagnostic parameter to determine the presence and severity of periodontal lesions, and in the assessment of periodontal treatment. The probe enables the clinician to determine pocket depths and attachment levels, presence of inflammation (bleeding on probing and suppuration), presence of plaque and calculus, and irregularities in root configuration.[1]

Obtaining reliable measurements of pocket depth and attachment level is obviously critical to both longitudinal clinical studies and routine clinical assessment of periodontal therapy. Current probing methods are subject to various errors. Variations in probing force are evident between different examiners and in different sites for a single examiner.[1-3] The degree of penetration of the probe tip is also influenced by the presence of inflammation and when inflamed the probe stops at the level of intact connective tissue fibers 0.3 to 0.5 mm apical to the termination of the junctional epithelium. Probe angulation, probe tip dimension, and pocket depth will also affect reproducibility.[4] Errors in visual assessment, rounding off to the nearest mm, recording errors, variations in probe markings, and patient cooperation must also be considered. Finally, even the use of a stent to guide angulation of the probe does not significantly affect reproducibility.[5]

To date, the periodontal probe developed by William CHM has been one of the most popular instruments for the examination of pockets. William was a periodontist who specialized in the study of the relationship between pocket formation and focal infection.[6-8] During the late 1950s, few other authors like Goldman et al,[9] Orban et al,[10] Glickman[11] published their text on importance of periodontal probe in diagnosis , prognosis, and treatment. All authors agreed and supported use of the William's probe which was rod shaped with 1, 2, 3, 5, 7, 8 and 9 mm markings, and a 1.0 mm diameter at the tip. Goldman et al[9] stated that 'Clinical probing with suitable periodontal instruments, such as William's calibrated probe is a prime necessity in delineating the depth, topography and character of the periodontal pocket'.[12]

Modifications of William's probe were described by many authors. The best-known examples are probably the probes of Goldman and Fox, Nabers, Drellich, Cross and Gilmore. Today, the University of North Carolina probe (PCP-UNC 15, Hu-Friedy Manufacturing Co., Chicago, IL, USA), with color coding of every millimeter demarcation, is probably the preferred instrument in clinical research if conventional probes are required.[8]

The World Health Organization (WHO) recommended a special periodontal probe for use with the community periodontal index of treatment needs (CPITNs). It was designed by J Ainamo and G Beagrie, and is different from other probes because of its ball-end of 0.5 mm in diameter and tip is hemispheric in shape, which is attached to a 16 mm long tapered tip. Tip and shank, and shank and handle include angles of 90 and 30° respectively. The tip of the clinical probe has markings at 3.5, 5.5, 8.5, and 11.5 mm. The ball-end permits the clinician to detect root

[1,3-5]Postgraduate Student, [2]Professor

[1-4]Department of Periodontology and Implantology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

[5]Department of Public Health Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

Corresponding Author: Garima Singh, Postgraduate Student Department of Periodontology and Implantology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India, e-mail: garimasngh5@gmail.com

Figs 1A to C: (A) William's probe, (B) UNC-15 probe and (C) CPITN probe

surface roughness like calculus deposits. The probe has been advocated for use in epidemiology and the routine periodontal screening of patients in general practice.[13]

Though different generations of probes have been developed which have been upgraded from manual to automated with advantage of constant force, computer-interfaced electronic recording, and precision in probe angulation. Studies have shown that the reproducibility of probing over a relatively short period of time may be similar for the conventional and a constant force probe. Wang et al[14] concluded that, overall, better reproducibility can be achieved with the conventional than with the electronic probe when compared by tooth surface, tooth type, dental arch or patient.

Therefore, the manual probe is still the preferred instrument by clinicians. Thus, the present was designed to compare the relative accuracy and reproducibility of three different most commonly used manual periodontal probes (Figs 1A to C).

MATERIALS AND METHODS

Subjects

Total 10 patients were enrolled for the study. Subjects were selected based on the inclusion criteria, i.e. mild to moderate periodontitis, age 20 to 55 years, and with minimum of 20 permanent teeth. Probing measurements were taken on three index teeth per quadrant, i.e. 1 molar, 1 premolar, 1 incisor at 6 sites per tooth (i.e. mesiobuccal, midbuccal, distobuccal, distolingual, midlingual, and mesiolingual). Measurements were taken with the help of stents for the standardization, after thorough scaling and root planning to eliminate the chances of hindrance in probing by deposits inside the pockets. While patients with severe periodontitis, i.e. pocket depth beyond 10 mm, systemic disease or using tobacco were excluded from the study. Following information regarding the purpose of the study and informed consent, intraoral photographs were taken to record the relative position of the experimental teeth.

Probing Method

The two main determinant of periodontal disease, i.e. clinical attachment level (CAL) and probing pocket depth (PD) were taken. Periodontal measurements were taken repeatedly with the three probes on same subjects by same trained dental professional to minimize the operator bias. Data recorded were rounded up to the nearest millimeter calibration on the desired probe. Probing measurements were measured with the probe tip parallel to the long axis of the tooth.

STATISTICAL ANALYSIS

Average of each tooth was made for the six sites probed. The data were entered in a personal computer using statistical package for social sciences (SPSS) software. The values were represented in number and mean ± standard deviation. The student paired t-test was used to compare correlation coefficients between each of the manual probes. A p-value less than 0.05 was considered as statistically significant.

RESULTS

Probing Depth (mm)

Mean of probing depth in anterior index tooth was with 3.33 ± 3.70, 3.23 ± 2.0 and 4.78 ± 2.17 mm with William's, UNC-15 and CPITN probe respectively. Differences b/w results compared between William's and UNC-15 probe were statistically insignificant (Table 1). Thus, precision and reproducibility was obtained more with UNC-15. Comparing PD measurements of William's and UNC-15 with CPITN were statistically significant (Tables 2 and 3),

Table 1: Comparison of mean probing depth (mm) between William's and UNC-15 probe

	William's probe	*UNC-15 probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.33 ± 3.80	3.23 ± 2.0	>0.05 NS
Premolar	3.21 ± 2.35	3.53 ± 2.47	>0.05 NS
Molar	3.81 ± 2.79	4.01 ± 2.87	>0.05 NS

NS: Nonsignificant

Table 2: Comparison of mean probing depth (mm) between UNC-15 and CPITN probe

	UNC-15 probe	*CPITN probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.23 ± 2.0	4.78 ± 2.17	<0.01 S
Premolar	3.53 ± 2.47	4.84 ± 2.47	<0.01 S
Molar	4.70 ± 2.87	5.28 ± 2.38	>0.05 NS

NS: Nonsignificant; S: Significant

Table 3: Comparison of mean probing depth (mm) between William's and CPITN probe

	William's probe	*CPITN probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.33 ± 3.80	4.78 ± 2.17	<0.01 S
Premolar	3.21 ± 2.35	4.84 ± 2.47	<0.01 S
Molar	3.81 ± 2.79	5.28 ± 2.38	<0.01 S

S: Significant

indicating more bias and variation with CPITN. Similar variation was obtained when comparing the results of each indexed teeth.

Clinical Attachment Level (mm)

Mean attachment loss as measured from cementoenamel junction (CEJ) to the base of the pocket on anterior index tooth was 3.33 ± 2.58, 3.23 ± 2.62, and 4.80 ± 3.33 mm with William's, UNC-15 and CPITN probe respectively. Differences in results between William's and UNC-15 probe were statistically insignificant (Table 4). Comparing differences in results between William's and UNC-15 with CPITN probe were statistically significant (Tables 5 and 6).

DISCUSSION

The results of the present study showed that for William's and UNC-15 probe, very similar results were obtained as compared with those from CPITN probe. These might be due to the reasons, like difference in calibration quality,[15] effect of probing handle on probing forces,[16] corrugated structure of probe surface,[17] diameter and shape of the probe tip.[17]

The digit preference effect provided a plausible explanation.[18-20] Digit preference describes rounding bias associated with specific instruments and can bias the observed distribution of values. This effect is most pronounced for PD measurements as with CAL. Thicker diameter of William's and UNC-15 probes (0.6-1 mm) resulted in lower probing depth measurements.[12]

Table 4: Comparison of mean attachment loss (mm) between William's and UNC-15 probe

	William's probe	*UNC-15 probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.33 ± 2.58	3.23 ± 2.62	>0.05 NS
Premolar	3.21 ± 2.40	3.53 ± 2.47	>0.05 NS
Molar	3.81 ± 3.51	4.70 ± 3.38	>0.05 NS

NS: Nonsignificant

Table 5: Comparison of mean attachment loss (mm) between UNC-15 and CPITN probe

	UNC-15 probe	*CPITN probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.23 ± 2.62	4.80 ± 3.33	<0.01 S
Premolar	3.53 ± 2.47	4.68 ± 2.56	<0.01 S
Molar	4.7 ± 3.38	5.23 ± 2.38	<0.01 S

S: Significant

Table 6: Comparison of mean attachment loss (mm) between William's and CPITN probe

	William's probe	*CPITN probe*	*p-value*
	Mean ± SD	*Mean ± SD*	
Anterior teeth	3.33 ± 2.58	4.80 ± 3.33	<0.01 S
Premolar	3.21 ± 2.40	4.68 ± 2.56	<0.01 S
Molar	3.81 ± 3.51	5.23 ± 2.38	<0.01 S

S: Significant

Thin diameter CPITN probe (0.5 mm) over probed the sulcus and extended to the base of junctional epithelium.[12] Also, as CPITN is an epidemiological probe with 4.5 and 6.5 markings missing, it is less precise. Thus, the measurements taken by CPITN are more prone for observational bias. Similar probing depth was found in a study comparing William's and WHO probe, i.e. William's probe appeared to be twice as accurate as the CPITN probe.[21]

Another study concluded comparing manual probes that UNC-15 is not suitable for screening purposes due to digit preference effect.[22] Variations in precision of periodontal measurements have also been found to be due to type of teeth,[23] sites of measurement,[23,24] probing force,[12,19,24] probe placement and angulation,[25] visual and tactile difficulty in detecting the CEJ,[24,26] and erroneous recording of measurements.[8,12]

CONCLUSION

In accordance with results of this study, UNC-15/William's probe should be used for more precised clinical evaluation. CPITN is a probe for a broad scale assessment of periodontal disease with less accuracy. Thus, standardization of periodontal probes to enhance the accuracy and reproducibility of periodontal measurements in clinical and epidemiological studies should be considered.

REFERENCES

1. Mayfield L, Bratthall G. Attstrom R. Periodontal probe precision using 4 different periodontal probes. J Clin Periodontol 1996;23:76-82.
2. Freed HK, Gapper RL, Kalwarf KL. Evaluation of periodontal probing forces. J Periodontol 1998;54:488-492.
3. Gabalhuler H, Hasseu TF. A pressure-sensitive periodontal probe. H Odontologica Acta 1971;15:114-117.
4. Listgarten MA. Periodontal probing—what does it mean? J Clin Periodontol 1980;7:165-192.
5. Watts T. Constant force probing with and without a stent in untreated periodontal disease: the clinical reproducibility problem and possible sources of error. J Clin Periodontol 1987;14:407-411.
6. William CHM. Some newer periodontal findings of practical importance to the general practitioner. Can Dent Assoc 1936; 2:333-340.
7. William CHM. Rationalization of periodontal pocket therapy. J Periodontol 1943;14:67-71.
8. Hefti AF. Periodontal Probing. Crit Rev Oral Biol Med 1997; 8(3):336-356.

9. Goldman HM, Schluger S, Fox L. Periodontal therapy. St. Louis: CV Mosby; 1956. p. 27.
10. Orban B, Wentz FM, Everett FG, et al. Periodontics, a concept—theory and practice. St. Louis: CV Mosby Co; 1958. p. 103.
11. Glickman I. Clinical Periodontology. Philadelphia: WB Saunders Co; 1958. p. 548.
12. Garnick JJ, Silverstein L. Periodontal Probing: probe tip diameter. J Periodontol 2000;71:96-103.
13. Aniamo J, Barmes D, Beagrie G, et al. Development of the World Health Organization (WHO) community periodontal index for treatment needs (CPITN). Int Dent J 1982;32:286-291.
14. Wang SF, Leknes k, Zimmerman GJ, et al. Reproducibility of periodontal probing using a conventional manual and an automated force-controlled electronic probe. J Periodontol 1995;66:38-46.
15. Hassell TM, Germann MA, Saxer UP. Periodontal probing: investigator discrepancies and correlation between force and recorded depth. H Odontologica Acta 1973;17:38-42.
16. Van Weringh M, Barendregt DS, Rosema NA, et al. A thin or thick probe handle: does it make a difference? Int J Dental Hyg 2006;4:140-144.
17. Atassi F, Newman HN, Bulman JS. Probe tine diameter and probing depth. J Clin Periodontol 1992;19:301-304.
18. Hensel E, Gesch D, Biffar R, et al. Study of health in pomerania (SHIP): a health survey in an East German region. Objectives and design of the oral health section. Quintessence Int 2003; 34:370-378.
19. Larsen C, Barendregt DS, Slot DE, et al. Probing pressure, a highly undervalued unit of measure in periodontal probing: a systematic review on its effect on probing pocket depth. J Clin Periodontol 2009;36:315-322.
20. Volzke H, Alte D, Schmidt CO, et al. Cohort profile: the study of health in Pomerania. Int J Epid 2011;40:294-307.
21. Van der Zee E, Davies EH, Newman HN. Marking width, calibration from tip and tine diameter of periodontal probes. J Clin Periodontol 1991;18:516-520.
22. Holtfreter B, Alte D, Schwahn C, et al. Effects of different manual periodontal probes on periodontal measurements. J Clin Periodontol 2012;39(11):1032-1041.
23. Grossi SG, Dunford RG, Ho A, et al. Sources of error for periodontal probing measurements. J Periodont Res 1996; 31:330-336.
24. Reddy MS, Palcanis KG, Geurs NC. A comparison of manual and controlled-force attachment-level measurements. J Clin Periodontol 1997;24:920-926.
25. Persson GR. Effects of line-angle versus mid-proximal periodontal probing measurements on prevalence estimates of periodontal disease. J Periodontol Res 1991;26:527-529.
26. Watts T. Constant force probing with and without a stent in untreated periodontal disease: the clinical reproducibility problem and possible sources of error. J Clin Periodontol 1987;14:407-411.