Comparison of Precision of Three Manual Periodontal Probes on Periodontal Measurements

Garima Singh, Hirak S Bhattacharya, Sidharth Shankar, Kausar Parwez Khan, 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 significant, 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.


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 Glickman11 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 al12 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'.

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 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...
surface roughness like calculus deposits. The probe has been advocated for use in epidemiology and the routine periodontal screening of patients in general practice.\textsuperscript{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\textsuperscript{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 |

Figs 1A to C: (A) William’s probe, (B) UNC-15 probe and (C) CPITN probe
ing more bias and variation with CPITN. Similar
tooth was 3.33 ± 2.58, 3.23 ± 2.62, and 4.80 ± 3.33 mm
Differences in results between William’s and UNC­15
was statistically significant (Tables 5 and 6).

**Clinical Attachment Level (mm)**

Mean attachment loss as measured from cementoenamel
junction (CEJ) to the base of the pocket on anterior index
diameter of William’s and UNC­15 probes (0.6­1 mm)
and UNC­15 probe, very similar results were obtained as

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S: Significant

**DISCUSSION**

The results of the present study showed that for William’s
and UNC-15 probe, very similar results were obtained as

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S: Significant

Thin diameter CPITN probe (0.5 mm) over probed
sulcus and extended to the base of junctional
epithelium. 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.

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

**CONCLUSION**

In accordance with results of this study, UNC-15/William’s
probe should be used for more precise 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.

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