



ORIGINAL ARTICLE

Accuracy and reproducibility of probe forces during simulated periodontal pocket depth measurements



K.N. Al Shayeb ^{*}, W. Turner, D.G. Gillam

Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, New Road, London E1 2BA, United Kingdom

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KEYWORDS

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Abstract *Aim:* The aim of the present study was to measure the accuracy and reproducibility of probe forces in simulated assessments of periodontal pocket depth. The study included experienced and inexperienced examiners and used manual and pressure-sensitive probes.

Materials and methods: Sixty-one participants were divided into seven groups and asked to probe selected anterior and posterior sites with three different probes (Williams 14W, Chapple UB-CF-15, and Vivacare TPS probes). The model was positioned on a digital electronic balance to measure force, which was recorded initially and after 15 min. Probe preferences were recorded. Accuracy was measured by comparing to a standardized 25 g force, and reproducibility was calculated for all duplicate measurements.

Results: The Vivacare probe produced the most accurate and most reproducible forces, whereas the Williams probe produced the least accurate and least reproducible forces. Probe forces were lighter at anterior sites compared to posterior sites at baseline. Probe forces were reduced at both sites after 15 min compared to baseline.

Conclusions: Vivacare TPS periodontal probes are more accurate and reproducible than Chapple and Williams probes. Many clinicians in this study preferred the Chapple probe.

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1. Introduction

Periodontal pocket depth measurements are used to diagnose and manage periodontal disease (Anderson and Smith, 1988). There are three major elements that contribute to the accuracy of periodontal pocket depth measurements. The first is related to the nature of the disease process, and includes the root anatomy, subgingival obstruction, the tissue condition at the deepest part of the pocket, and pain provoked by probing. The second element concerns probe features, such as the probe

^{*} Corresponding author. Tel.: +00966503927446.

E-mail addresses: kshayeb@yahoo.com (K.N. Al Shayeb), w.turner@qmul.ac.uk (W. Turner), d.g.gillam@qmul.ac.uk (D.G. Gillam).

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type and shape, which can affect the accuracy and precision of pocket measurements. Finally, the operator technique can influence measurements, including probe angle, probe force, probing pattern, accuracy of the reference point, and training or calibration (Gabathuler and Hassell, 1971; Listgarten, 1972, 1980; Van Der Velden and De Vries, 1978; Goodson et al., 1982; Theil and Heaney, 1991).

Operator training/technique is considered the most vital determinants of reproducibility and accuracy (Ramfjord, 1959). To achieve optimum probe force reproducibility and accuracy, operators should use a measurement tool that enables these objectives. Although some studies show no significant differences in accuracy and reproducibility between naive and expert practitioners when using automated probes (Samuel et al., 1997; Baker et al., 1997), the need for training is still evident.

Probing is an uncomfortable procedure for the patient (Tupta-Veselicky et al., 1994), especially when the probe force exceeds 45 g (Waal, 1986). It has been suggested that probe forces between 20 and 25 g (i.e., 0.20–0.25 N) cause minimal discomfort and still enable accurate diagnostic readings (Polson et al., 1980; Garnick et al., 1989; Armitage et al., 1977). A number of periodontal probes have been developed and modified to achieve that force setting.

Previous studies (Hunter et al., 1994; Gillam et al., 1998) reported that Vivacare probes (VPs) provided more accurate and consistent probe pressures compared to other probe types. Recently, a Chapple probe (CP) was introduced in the UK for periodontal monitoring. The aim of the present study was to measure the accuracy and reproducibility of experienced and inexperienced examiners using the VP, CP, and Williams probe (WP).

2. Materials and methods

The present study was conducted to replicate the Gillam et al. (1998) study. A total of 61 practitioners participated in the study. Participants were divided into two main categories based on experience. The experienced group was trained to use periodontal probes and used them in daily practice. Practitioners in the inexperienced group had never used periodontal probes (Table 1). The experienced category ($n = 42$) included five groups: 20 postgraduate students (10 periodontal (group 1) and 10 prosthodontic (group 2)), 9 consultants/specialists and specialist registrar (SPR) (group 3), 9 general dental practitioners (group 4), 4 qualified therapists/hygienists (group 5). The range of practice time for the experienced group was between 2 and 34 years. The inexperienced category

($n = 19$) included 10 dental nurses (group 6) and 9 first-year dental students (group 7).

Three different probes were used in this study. The WP is a conventional first-generation probe, whereas the other probes contain pressure indicators. The WP (Hu-Friedy Mfg. Co., LLC, UK) had a flat end with a 0.5-mm tip diameter according to the manufacturer's specifications. The CP (Implantium, Shrewsbury, UK) and VP (Ivoclar Vivadent, Enderby, UK) each had a 0.5-mm diameter ball-end, according to the manufacturers' specifications. Pressure-indicating marks were present on the CP and VP. When the operator force reached 25 g, the shank moved up to match the mark. Before conducting the study, all examiners were given sufficient time to familiarize themselves with the various probe types.

Participants were asked to probe selected anterior and posterior sites on a model attached to a digital electronic balance (Salter Housewares, Tonbridge, UK), which was adjusted to zero prior to the exercise (Fig. 1). The balance was positioned so that the participant could not observe the digital reading. Probes were given randomly to each participant, and measurements for both sites for each probe type were recorded. After a 15-min break, each participant was asked to repeat the exercise. All probe measurements were recorded on a data collection form. Participants' probe preferences were also recorded after completion of the exercise.



Figure 1 Digital electronic scale (Salter Housewares, Tonbridge UK) was used to measure the probing force.

Table 1 Description of study participants (7 groups, $n = 61$).

Group Number	Participants	Gender		Total
		Female	Male	
Experienced Participants ($n = 42$)				
1	Periodontal Postgraduate student	8	2	10
2	Prosthodontics Postgraduate student	4	6	10
3	Consultants, specialists and SPR	3	6	9
4	General dental practitioners (GDP)	3	6	9
5	Therapist and hygienist	4	0	4
Inexperienced Participants ($n = 19$)				
6	Dental nurses	10	0	10
7	First year dental undergraduates students	5	4	9

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