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Inter-examiner variances of pocket depth probing between periodontists and referring specialists

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Aim: Pocket depth measurements are the main criteria for diagnosing and assessing periodontal disease progression and for the referral of patients to a periodontist. The aim of this study was to assess the inter-examiner variances of pocket depth measurements between two periodontists, an orthodontist, an oral surgeon and an endodontist.

Study design: A total of 316 sites in 15 patients with aggressive periodontitis were measured by two periodontists, one orthodontist, one oral surgeon and one endodontist. Inter-examiner variations were analysed by the Spearman correlation test, Wilcoxon signed rank test, intra-class correlation and limits of agreement.

Results: The results of this study show that the pocket depth measurements of dentists from other specialties were always lower compared with the periodontists ($p < 0.0001$). The inter-examiner reliability analysis revealed that the oral surgeon had acceptable–excellent correlation compared with the periodontists, while the endodontist and the orthodontist had acceptable–moderate correlation. The limits of agreement analysis showed that 40%, 30% and 20% of the measurements of the surgeon, endodontist and orthodontist respectively were the same as those of the periodontists.

Conclusions: The results of this study emphasise the importance of the development of a probe design, either automated or manual, with constant force, and a guidance system to ensure proper angulations. Only then will the dentists be able to perform accurate probing to diagnose and differentiate certain situations, which will subsequently help them to perform appropriate treatment or to refer on time.

■ Introduction

Pocket depth and attachment level measurements are still the most important and most frequently used diagnostic tools to determine the presence, progression and severity of destructive periodontal diseases[1,2]. These measurements are assessed by manual and automated periodontal probes, and many studies have been conducted to assess the reliability of these probes[3–9]. The intra- and inter-examiner consistencies of the data of these probes are still to be determined and it has been reported that

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the standard deviation of conventional probes is ± 0.82 mm[10-15]. The reliability of probing measurements depends mainly on the location of the pocket, the angulation and physical properties of the probe, the disease status and on the clinician performing the measurements[9,15-17].

The current gold standard for assessing periodontal disease progression or response to treatment in clinical studies also involves the probing of pocket depth and attachment level either by the same examiner in repeated measurements or by different examiners, particularly in longitudinal studies[10,12-16]. Besides periodontology, these measurements are also used in other fields of dental science such as oral surgery[18-20], orthodontics[21-24] and endodontics[25,26].

While significant intra- and inter-examiner variations of probing pocket depth have been reported even among experienced periodontists who use the probes most frequently, to our knowledge there are no studies that compare the probing depth measurements of dentists belonging to various specialties. Therefore, the aim of this study was to assess the inter-examiner variances of probing measurements between two periodontists, an orthodontist, an oral surgeon and an endodontist.

■ Study design

The study protocol was approved by the institutional review board, and all patients involved in the study provided written informed consent.

Two periodontists, an orthodontist, an oral surgeon and an endodontist, each with at least 5 years of experience, agreed to participate in the study. They were all re-trained by another experienced periodontist in the theoretical and clinical aspects of periodontal probing. Each specialist was asked to undertake probing of 100 sites for ten patients in order to verify if their intra-examiner calibration readings reached an acceptable standard. All patients were examined twice with at least a 10-minute break between examinations. The intra-examiner calibration results were accepted if the repeated measurements were similar at a ≥ 90% level.

Finally, each of these five examiners measured probing depths of 15 patients with aggressive periodontitis who had pocket depths ranging from 1 mm to 12 mm. A UNC-15 manual probe was used in this study. All the teeth present were recorded, except third molars, and the measurements were taken from four sites of each tooth: mesio-buccal, disto-buccal, mid-vestibular and mid-lingual. All measurements were carried out under standard conditions in terms of ergonomic positions, and the sequence of examiner probing was rotated. As it has been reported that repeated probing of the same site in less than 5 minutes could induce changes within the pocket that can influence subsequent measurements, at least 10 minutes were allowed to elapse between each examiner. The dentists were blinded to each other's measurements. Each examiner probed a total of 316 sites.

■ Statistics

The probing depth measurements of the two periodontists were pooled and averaged, and the obtained data were included as single measurements in the statistical analysis. Probing depth was considered as a continuous variable and Spearman correlation test was used to analyse the inter-examiner agreement between two periodontists and other dentists. In addition, inter-examiner variation for each region between periodontists and other dentists was calculated by the Wilcoxon signed rank test. Inter-examiner agreement was assessed by using intra-class correlation (ICC) and limits of agreement (LOA) by a computer program (SPSS v.12.0).

ICC was expressed according to Goulet and Clark[27] as:

- 'unacceptable' (values between 0.00 and 0.39);
- 'moderate' (values between 0.40 and 0.59);
- 'acceptable' (values between 0.60 and 0.79);
- 'excellent' (values between 0.80 and 1.00).

■ Results

The results showed high correlation between two periodontists (r = 0.92). Table 1 shows that the probing depth measurements of the dentists from other specialties were statistically lower compared with the periodontists ($p < 0.0001$), in both the anterior and posterior regions. The correlation and the inter-examiner reliability analysis of other dentists compared with the periodontists, determined by Spear-

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Table 1 Mean pocket depth measurements (mm, mean ± SEM) according to the examiner and region. Results in parentheses are mean difference from the periodontists.

	Periodontists	Surgeon	Endodontist	Orthodontist
Anterior (n = 162)	4.42 ± 0.16	4.01 ± 0.15* (–0.40)	3.46 ± 0.12* (–0.96)	3.00 ± 0.11* (–1.41)
Posterior (n = 154)	4.25 ± 0.12	3.44 ± 0.10* (–0.81)	3.07 ± 0.08* (–1.18)	2.86 ± 0.07* (–1.39)
Total (n = 316)	4.34 ± 0.10	3.73 ± 0.09* (–0.60)	3.27 ± 0.08* (–1.06)	2.93 ± 0.07* (-1.40)

p < 0.0001 for surgeon, endodontist and orthodontist versus periodontists for anterior, posterior and total.

Table 2 Inter-examiner correlation with Spearman test and reliability with intra-class (ICC) statistics.

		Periodontists		
		Anterior (n = 162)	**Posterior (n = 154)**	**Total (n = 316)**
Surgeon*	Correlation r-value ICC (%95 CI) Value	0.83 0.86 (0.82–0.90) Excellent	0.60 0.67 (0.57–0.75) Acceptable	0.73 0.80 (0.76–0.84) Excellent
Endodontist*	Correlation r-value ICC (%95 CI) Value	0.79 0.77 (0.70-0.83) Acceptable	0.54 0.56 (0.44–0.66) Moderate	0.69 0.71 (0.65–0.76) Acceptable
Orthodontist*	Correlation r-value ICC (%95 CI) Value	0.73 0.77 (0.69-0.87) Acceptable	0.52 0.41 (0.27–0.53) Moderate	0.65 0.66 (0.59–0.71) Acceptable

** p < 0.01*

Table 3 Limits of agreement of the specialists with the periodontists.

		Anterior		Posterior		Total	
		n	**%**	**n**	**%**	**n**	**%**
Surgeon	Same as the periodontists	74	45.7	55	35.7	129	40.8
	± 1 mm	67	41.3	63	40.9	130	41.2
	≥ or ≤ 2 mm	21	13.0	36	23.4	57	18.0
Endodontist	Same as the periodontists	55	34.0	41	26.6	96	30.4
	± 1 mm	57	35.2	58	37.7	115	36.4
	≥ or ≤ 2 mm	50	30.8	55	35.7	105	33.2
Orthodontist	Same as the periodontists	33	20.4	32	20.8	65	20.6
	± 1 mm	58	35.8	59	38.3	117	37.0
	≥ or ≤ 2 mm	71	43.8	63	40.9	134	42.4

man test and ICC statistics respectively, showed that the oral surgeon had acceptable–excellent correlation while the endodontist and the orthodontist had acceptable–moderate correlation (Table 2). The LOA analysis showed that while 40% of the measurements of the surgeon were the same as those of the periodontists, this value was only 30% and 20% of the measurements of the endodontist and orthodontist respectively (Table 3). Of the measurements of the orthodontist, 42.4% had a variation of ± 2 mm or more compared with the periodontists.

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■ Discussion

The aim of this study was to assess the probing depth differences between dentists belonging to various specialties. The results of this study cannot be generalised for all specialists, since probing is highly individualistic and can be affected by various personal factors such as the experience of the clinician, the expertise of dealing with gingival tissues, and the familiarity or frequency of the use of periodontal probes. However, since probing depth measurements still remain the gold standard for the diagnosis of periodontal diseases and constitute the main criteria for the referral of patients to a periodontist, our main purpose was to determine whether dentists from various specialties could adequately evaluate pocket depths after education and training.

Overall, the results of this study have shown that the pocket depth measurements of dentists from other specialties were always lower compared with the periodontists, on both the anterior and posterior teeth. Correlation to the periodontist was highest with the oral surgeon, followed by the endodontist. The orthodontist had the least correlation with the periodontists. It may be conjectured that the surgeons who deal with oral soft tissues more often than the other two specialists may be more capable of probing pockets. Orthodontic and endodontic therapy is usually performed on dental hard tissues only, which may result in these specialists being less familiar with working on gingival tissues. It should be noted that the clinical attachment level measurement from the cemento-enamel junction or another fixed point, which is considered to be more difficult than pocket depth measurement, was not assessed in this study. It may be assumed that the intra-examiner differences would be more important in that case.

The main importance of probing depth measurements is the diagnosis of periodontal diseases. Other dental specialists may also be able to accurately diagnose periodontal diseases without accurate probing, especially in advanced cases. However, when the disease is limited to several teeth or a certain site of a tooth, the need for acceptable probing is obvious. Furthermore, the differential diagnoses of certain conditions also rely on accurate probing. For example, the main criteria for establishing the difference of a periodontal abscess from an endodontic abscess requires the detection of a deep periodontal pocket extending into the abscess[25]. In the field of oral surgery, it is very important to recognise the pocket depths of peri-implant tissues, in order to recognise an early inflammation[28]. In addition, determining the long-term prognosis of re-implanted traumatised teeth also relies on precise probing[20]. Accurate probing is also important for orthodontists, who usually treat patients in puberty and adolescence[16,22-24]. Certain forms of destructive periodontal diseases, such as aggressive periodontitis, are usually diagnosed during these periods, and orthodontists may be the first to recognise and refer the patients with these conditions to a periodontist. Finally, pocket depths must be detected correctly by orthodontists when planning appropriate orthodontic treatment in adult patients, especially for those who had previous destructive periodontal diseases[22].

The results of this study emphasise the importance of the development of a probe design, either automated or manual, with constant force, and a guidance system to ensure proper angulations. Only then will the examiner–related variables such as experience and familiarity with periodontal probes be rendered less important and allow clinicians to adequately diagnose periodontal diseases.

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