Original Article

Comparative assessment of conventional periodontal probes and CEJ handpiece of electronic probes in the diagnosis and primary care of periodontal disease

Harshita Bareja[1,2], Monika Bansal[1], PG Naveen Kumar[3]

[1]Unit of Periodontics, [3]Unit of Preventive and Community Dentistry, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, [2]2/4 Spring Grove, Handerson, Auckland, New Zealand

Abstract

Objectives: Conventional probes (CPs) have been considered acceptable as diagnostic tools to measure probing pocket depth (PPD) and clinical attachment level (CAL) but are affected by multiple variables. Electronic probes (EPs) provide controlled force, digital readout and data storage in computers. The objectives were to compare the reproducibility in the measurement of PPD and CAL by CP and the newly introduced CEJ handpiece of EP and intra-examiner and inter-examiner errors done in two phases. **Methods and Material:** Selected 720 periodontal sites in 1st molar of 30 persons with chronic periodontitis ≤4 mm and >4 mm pockets were analysed by two trained investigators in two phases at 2 hours difference by CP and CEJ handpiece of EP. Standard deviation, mean difference, correlation coefficient, *P* value and student 't' test were done to analyse data. **Results:** The intra- examiner and inter-examiner analyses revealed that Pearson's correlation coefficient was above 0.080 and 0.722 in the ≤4 mm and >4 mm pockets, respectively. Mean difference was not statistically significant in both groups except in the intra- examiner findings in the 2nd phase. Interprobe analysis depicted a standard error of mean of <0.03 in ≤4 mm pockets, whereas it varied from 0.047–0.056 in >4 mm pockets. **Conclusion:** In conclusion, EP is advantageous for research purposes by providing automatic recording and long-term maintenance of data storage without the need of an assistant and patient education and motivation, whereas CP appears to be more useful in routine periodontal examination.

Keywords: Clinical attachment level, conventional probe, electronic probe, pocket probing depth

Introduction

Periodontal diseases have long been diagnosed based on various factors such as bleeding on probing, probing depth, clinical attachment level, presence or absence of other factors such as pain, ulceration, mobility, amount of plaque and calculus. To arrive at a diagnosis, microorganisms from the subgingival area and gingival crevicular fluid (GCF) are being evaluated to examine the microorganisms and inflammatory mediators and host tissue products, respectively. A genetic test to diagnose chronic periodontitis is also in research.[1] The American Academy of Periodontology 2003[2] reported that the evaluation of gingival crevicular fluid, subgingival microflora and genetic susceptibility tests are the advanced diagnostic aids and are not used routinely in clinics currently because these tests require the multidisciplinary approach and are difficult to perform. Above all, the diagnostic utility of some of them has not been confirmed to date. Therefore, clinical assessment by primarily probing the depth and clinical attachment level is still the main diagnostic tool for assessing periodontal diagnosis and treatment planning. This diagnostic tool helps in the early detection of the disease that will lead to early treatment and hence the prevention of irreversible destruction.

Address for correspondence: Dr. Monika Bansal, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi - 221 005, Uttar Pradesh, India.
E-mail: drmonika97@gmail.com

Received: 26-09-2020 **Revised:** 02-12-2020
Accepted: 21-12-2020 **Published:** 27-02-2021

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1994_20

How to cite this article: Bareja H, Bansal M, Naveen Kumar PG. Comparative assessment of conventional periodontal probes and CEJ handpiece of electronic probes in the diagnosis and primary care of periodontal disease. J Family Med Prim Care 2021;10:692-8.

Pocket probing depth (PPD) measurement is essential because pockets act as reservoirs for many microorganisms and further lead to the periodontal destruction that is simple, easy to record and gives a good assessment of the distribution of periodontal diseases. Moreover, periodontal probing helps in formulating the treatment plan for periodontal diseases. Clinical attachment level (CAL) gives a better overall assessment of periodontal health as compared to probing depth measurements and helps in determining the severity of the periodontal diseases as well as formulating the treatment plan and predicting the prognosis of the teeth. It is measured from the cemento-enamel junction (CEJ) or any fixed point to the base of the periodontal pocket but the CAL is more difficult to measure accurately because errors in recording CAL are unavoidable due to the difficulties in the exploration of CEJ.[3-5] At present, periodontal probes are the main diagnostic tools to measure PPD and CAL. Although probing depth measurements made by a conventional probe is reproducible and has been considered acceptable, but it is affected by multiple variables such as the probing force, probing technique, diameter of the tip of the probe, precision of probe calibration, angle of insertion of the probe, inflammatory condition of the soft tissues, lack of a stable reference point and errors in manual recordings and root anatomy.[6]

Electronic probing provides the controlled force during probing, digital readout and storage of data in the computer.[7] Earlier reports have demonstrated that measurements taken with EPs are less variable as compared to CP. The double pass method is helpful in minimizing the errors recorded by EPs.[8-12] Recently, a modification of the handpiece of EP has been introduced, i.e., CEJ probe handpiece which has an extended sleeve to detect the CEJ and hence is very helpful in recording CAL.[13] The width of the sleeve is long enough to detect the CEJ and short enough to not interfere with probing depth measurements.[14] Therefore, the objective of the present study was to compare the reproducibility of the measurement of PPD and CAL by CP and the newly introduced CEJ probe handpiece of EP as well as the intra- and inter-examiner measurement errors done in two phases.

Material and Methods

In the present study, 30 persons were recruited from the outpatient department after signing the consent. The study period was from April 2015 to May 2016. The inclusion criteria were: 1) persons suffering from chronic periodontitis having >4 mm periodontal pocket, ≥3 mm attachment loss in at least 30% sites and bleeding on probing, 2) 35–60 years age, 3) systemically healthy, 4) presence of all 1st molars and 5) no periodontal therapy in the last 6 months. The exclusion criteria were: 1) pregnant and lactating women, 2) mobile 1st molar or 1st molar with crown placement, 3) aggressive periodontitis, 4) acute oral diseases, and 5) antimicrobial therapy for 1 month prior to the study. The study protocol was approved by the Institutional Ethical Committee. The study protocol was approved from ethical committee. The date of approval is 20.03.2015.

A total of 720 periodontal sites in 30 persons were probed with two periodontal probes, i.e., conventional probe (CP) and electronic probe (EP) at two different phases which were scheduled 2 hours apart on the same day. The sites were randomly probed with CP and then with EP. Six sites, i.e., mesiobuccal, midbuccal, distobuccal, distolingual/distopalatal, mid lingual/palatal and mesiolingual/palatal in only 1st molar were examined by two trained investigators in each phase. To minimize the errors in recording, the double pass method was used and calculus was removed from the supra and subgingival sites with the help of an ultrasonic scaler and hand instruments so that there was no resistance while probing. The periodontal probes were positioned parallel to the long axis of the tooth and were always in contact with the tooth. Both PPD and CAL were recorded at each site that was divided into two groups: 1) sites with ≤4 mm pocket depth and 2) sites with >4 mm pocket depth. It was made sure that if a site in any phase either by CP or EP was recorded to have probing depth 4 mm was taken under group 1. CEJ was used as the fixed reference point for detection of CAL. Two periodontal probes that were used in the study were a CP (UNC-15, Hufriedy, USA) and the CEJ handpiece of an automated EP (Florida Probe, USA). The measurements were rounded to the nearest millimetre.

Measurements of PPD and CAL by CP

The probe was inserted into the periodontal pocket and PPD was measured from the gingival margin to the base of the pocket. CAL was measured from the CEJ to the base of the pocket. These measurements were entered by an assistant. CP provides no standardising probing force and has markings at every millimetre upto 15 mm with colour codes at 5, 10 and 15 mm. The diameter of the probe tip is 0.50 mm.

Measurements of PPD and CAL by automated EP

Automated EP provides controlled force of 15 gm by coil springs inside the probe handpiece and consists of a CEJ probing hand piece, optical encoder, footswitch and computer and digital read out. The diameter of the probe tip is 0.4 mm. This probe has a 0.125 mm prominent edge at the end of the sleeve that facilitates a "catch" of the CEJ. The width of this edge is small enough not to interfere with probing depth measurements, thus providing concurrent measurements of CAL and PPD. PPD recordings were accomplished by extending the probe tip through the sleeve of CEJ handpiece into the periodontal pocket and pressing down until the sleeve rests at the level of marginal gingiva. To calculate the CAL, gingival recession was added to the PPD or gingival hyperplasia was subtracted from the PPD that was recorded when the probe tip was passed through the modified sleeve of the CEJ handpiece and the sleeve was rested at the level of CEJ. The system may provide diagrammatic printouts of measurements for individual persons.

Statistical analysis

PPD and CAL measurements were statistically analysed. Standard deviation, mean difference, correlation coefficient, and student 't' test were performed to compare the intra-examiner,

inter-examiner and inter-probe data. The level of significance for the analysis was set at $P \leq 0.05$.

Results

In the present study, a total of 720 sites were recorded on six sites of all permanent first molars. The proportion of sites with probing depth upto 4 mm were 69.02% (497) and 30.97% (223) of sites had probing depths of more than 4 mm. PPD and CAL were recorded at each site by two examiners at two different phases, 2 hrs apart from using both EP and CP.

Intra-examiner analysis at sites with PD ≤4 mm [Table 1] revealed that the mean difference of PPD in both phases measured from CP and EP by the first examiner was 0.020 mm (P = 0.292) and 0.012 mm (P = 0.355), respectively. The mean difference of PPD in both phases measured from CP and EP by the second examiner was 0.030 mm (P = 0.147) and 0.010 mm (P = 0.669). Mean difference of CAL in both phases measured from CP and EP by the first examiner was 0.022 mm (P = 0.222) and 0.014 mm (P = 0.378) and that by the second examiner was 0.024 mm (P = 0.288) and 0.024 mm (P = 0.253). Pearson's correlation coefficient ranged from 0.854 to 0.960. Intra-examiner analysis in sites with PPD >4 mm [Table 1] showed that Pearson's correlation coefficient ranged from 0.791 to 0.956. The mean difference was ranged from 0.013 to 0.117. The *P* value ranged from 0.025 to 0.603. The *P* value of 0.025 (mean difference 0.117) was significant in PPD measured between the two phases by the first examiner using CP, whereas all other *P* values revealed no significant difference.

Inter-examiner analysis using either CP or EP in sites with PPD ≤4 mm [Table 2] revealed that the mean difference of PPD and CAL ranges from 0.018 mm to 0.028 mm in both phases. The correlation coefficient was ranged from 0.857 to 0.983. The mean difference in PPD and CAL by the two examiners was statistically insignificant as the *P* value ranged from 0.606 to 0.900. The inter-examiner comparisons using either CP or EP in sites with PD >4 mm [Table 2] demonstrated that the mean difference of PPD measured by CP was 0.018 mm (P = 0.873) and 0.058 mm (P = 0.601), and mean difference of PPD measured by EP was 0.009 mm (P = 0.927) and 0.067 mm (P = 0.498) in the first and second phase, respectively. Pearson's correlation coefficient for CP and EP was 0.896 & 0.863 and 0.937 & 0.930 in the first and second phase, respectively. Mean difference of CAL measured by CP or EP ranged from 0.009 to 0.067 mm. The correlation coefficient was ranged from 0.930 to 0.958. The difference in PPD and CAL by the two examiners was statistically insignificant as the *P* value ranged from 0.601 to 0.969.

Inter-probe data analysis is presented in Table 3. Sites with probing depth ≤4 mm revealed that the mean difference for PPD and CAL measured by both examiners in two phases ranged from 0.004 to 0.024, which is not statistically significant as the *P* value ranged from 0.092 to 1.037. The standard error of mean ranged from 0.006 to 0.025. The inter-probe data analysis in sites with probing depth >4 mm revealed that the standard error of mean varied from 0.047 to 0.056 and *P* value ranged from 0.00 to 1.692. The *P* value 0.00 reveals a significant difference in inter-probe readings by the first examiner in the second phase.

Discussion

Periodontal diseases are widely distributed globally and act as an independent risk factor for many systemic diseases or exacerbate the existing conditions like diabetes mellitus, preterm low birth weight babies, cardiovascular diseases, respiratory diseases, metabolic syndrome, obesity, Alzheimer's disease and

Table 1: Table showing the intra-examiner analysis

	Probe	Examiner	No. of sites	Phase 1 (mm±SD)	Phase 2 (mm±SD)	Mean difference 1st -2nd	Correlation coefficient	*P*	*t*
PPD ≤4 mm									
PPD	CP	Examiner 1	497	2.66±0.893	2.64±0.880	0.020±0.425	0.885	0.292	1.054
		Examiner 2	497	2.64±0.868	2.61±0.842	0.030±0.460	0.854	0.147	1.452
	EP	Examiner 1	497	2.66±0.891	2.65±0.882	0.012±0.291	0.946	0.355	0.926
		Examiner 2	497	2.63±0.875	2.64±0.853	0.010±0.314	0.934	0.669	0.428
CAL	CP	Examiner 1	497	2.64±1.290	2.62±1.280	0.022±0.404	0.951	0.222	1.223
		Examiner 2	497	2.63±1.270	2.60±1.240	0.024±0.507	0.920	0.288	1.061
	EP	Examiner 1	497	2.63±1.270	2.62±1.211	0.014±0.356	0.960	0.378	0.882
		Examiner 2	497	2.62±1.24	2.60±1.180	0.024±0.470	0.926	0.253	1.145
PPD >4 mm									
PPD	CP	Examiner 1	223	5.43±1.22	5.55±1.16	0.117±0.774	0.791	0.025	2.250
		Examiner 2	223	5.42±1.13	5.49±1.19	0.076±0.703	0.819	0.107	1.619
	EP	Examiner 1	223	5.35±1.04	5.34±1.061	0.013±0.383	0.933	0.603	0.521
		Examiner 2	223	5.36±1.03	5.41±1.03	0.045±0.339	0.946	0.320	1.014
CAL	CP	Examiner 1	223	4.52±1.77	4.48±1.69	0.049±0.705	0.918	0.297	1.044
		Examiner 2	223	4.53±1.78	4.49±1.71	0.040±0.639	0.934	0.347	0.943
	EP	Examiner 1	223	4.44±1.65	4.47±1.660	0.027±0.519	0.951	0.440	0.774
		Examiner 2	223	4.45±1.64	4.48±1.64	0.031±0.488	0.956	0.337	0.961

PPD=probing pocket depth. CAL=clinical attachment level. CP=conventional probe. EP=electronic probe. SD=standard deviation. *P*=significant at≤0.05

Table 2: Table showing the inter-examiner analysis

	Probe	Phases	No. of sites	Examiner 1 (mm±SD)	Examiner 2 (mm±SD)	Mean difference 1st-2nd	Correlation coefficient	*P*	*t*
PPD ≤4 mm									
PPD	CP	phase 1	497	2.66±0.893	2.64±0.868	0.018±0.056	0.919	0.746	0.324
		Phase 2	497	2.64±0.880	2.61±0.842	0.028±0.055	0.857	0.606	0.516
	EP	Phase 1	497	2.66±0.891	2.63±0.875	0.026±0.056	0.961	0.641	0.467
		Phase 2	497	2.65±0.882	2.64±0.853	0.008±0.055	0.966	0.884	0.146
CAL	CP	Phase 1	497	2.64±1.29	2.63±1.27	0.016±0.882	0.979	0.844	0.197
		Phase 2	497	2.62±1.28	2.60±1.24	0.018±0.080	0.970	0.821	0.226
	EP	Phase 1	497	2.63±1.27	2.62±1.24	0.010±0.080	0.983	0.900	0.126
		Phase 2	497	2.62±1.21	2.60±1.18	0.020±0.076	0.965	0.791	0.265
PPD >4 mm									
PPD	CP	phase 1	223	5.43±1.22	5.42±1.13	0.018±0.11	0.896	0.873	0.160
		Phase 2	223	5.55±1.16	5.49±1.19	0.058±0.111	0.863	0.601	0.523
	EP	Phase 1	223	5.35±1.04	5.36±1.03	0.009±0.098	0.937	0.927	0.091
		Phase 2	223	5.34±1.04	5.41±1.03	0.067±0.099	0.930	0.498	0.679
CAL	CP	Phase 1	223	4.52±1.77	4.53±1.78	0.009±0.169	0.990	0.958	0.053
		Phase 2	223	4.48±1.69	4.49±1.71	0.018±0.161	0.969	0.911	0.111
	EP	Phase 1	223	4.49±1.65	4.45±1.64	0.009±0.156	0.992	0.954	0.057
		Phase 2	223	4.47±1.66	4.48±1.64	0.015±0.156	0.988	0.931	0.086

PPD=probing pocket depth. CAL=clinical attachment level. CP=conventional probe. EP=electronic probe. SD=standard deviation. *P*≤0.05

Table 3: Table showing the inter-probe analysis within the examiner

	Examiners	Phases	No. of sites	CP (mm±SD)	EP (mm±SD)	Mean difference 1st-2nd	Standard error of mean	*P*	*t*
PPD ≤4 mm									
PPD	Examiner 1	Phase 1	497	2.66±0.893	2.66±0.891	0.004±0.504	0.023	0.859	0.178
		Phase 2	497	2.64±0.880	2.65±0.882	0.004±0.412	0.018	0.828	0.218
	Examiner 2	Phase 1	497	2.64±0.868	2.63±0.875	0.012±0.516	0.023	0.602	0.522
		Phase 2	497	2.61±0.842	2.64±0.853	0.024±0.519	0.023	0.300	1.037
CAL	Examiner 1	Phase 1	497	2.64±1.29	2.63±1.270	0.012±0.500	0.022	0.591	0.538
		Phase 2	497	2.62±1.28	2.62±1.211	0.004±0.550	0.025	0.870	0.163
	Examiner 2	phase 1	497	2.63±1.27	2.62±1.24	0.006±0.537	0.024	0.802	0.251
		Phase 2	497	2.60±1.24	2.60±1.18	0.006±0.646	0.006	0.835	0.208
PPD >4 mm									
PPD	Examiner 1	Phase 1	223	5.43±1.22	5.35±1.04	0.081±0.796	0.053	0.131	1.515
		Phase 2	223	5.55±1.16	5.34±1.061	0.211±0.763	0.051	0.00	4.127
	Examiner 2	Phase 1	223	5.42±1.13	5.36±1.03	0.054±0.702	0.047	0.253	1.145
		Phase 2	223	5.49±1.19	5.41±1.03	0.085±0.842	0.056	0.132	1.511
CAL	Examiner 1	Phase 1	223	4.52±1.77	4.44±1.651	0.081±0.712	0.048	0.092	1.693
		Phase 2	223	4.48±1.69	4.47±1.660	0.004±0.780	0.052	0.932	0.086
	Examiner 2	phase 1	223	4.53±1.78	4.45±1.64	0.081±0.706	0.047	0.089	1.708
		Phase 2	223	4.49±1.71	4.48±1.64	0.009±0.741	0.05	0.857	0.181

PPD=Probing pocket depth. CAL=clinical attachment level. CP=conventional probe. EP=electronic probe. SD=standard deviation. *P*≤0.05

rheumatoid arthritis.[15-17] Microorganisms or their products from the oral cavity may reach into the systemic circulation and exert their effects directly or indirectly by releasing the inflammatory mediators on the pathogenesis of these systemic diseases. Herpes virus from the oral cavity may also access the systemic circulation and is associated with systemic diseases.[18] The influence of oral health on the overall systemic health of the human being is considered under periodontal medicine which is an emerging branch of periodontology.[19]

All professional healthcare providers including medicine and dentistry together must understand the relationship of the oral cavity with the other organ systems and can protect the systemic health of an individual by reducing the oral infection. Adverse pregnancy outcomes are the major health problems associated with maternal periodontal infection that not only affect the mother and the newborn child but also the family as a whole and community.[20] Thus, the examination of the oral cavity and treatment of periodontal diseases should be included as an integral part to the clinical practice of primary care physicians who provide the comprehensive health care to an individual of family and community for prevention of disease and promotion of health.

Examination and diagnosis of the periodontal diseases are mandatory to assess the condition of periodontal health and determine the severity of the periodontal diseases which ultimately affect the systemic health. Periodontal probes are the primary diagnostic tools for this purpose. This study was conducted as an attempt to compare CP that has been used since decades and CEJ handpiece of EP which has been introduced recently because identification of best available probe in terms of accuracy and reproducibility is of utmost importance for the diagnosis and primary care of periodontal diseases. In the present study, 720 sites with probing depths ≤4 mm (497) and >4 mm (223) were analyzed separately and the double pass method was used to avoid the measurement errors in untreated subjects due to the presence of subgingival calculus that was suggested while probing in a previous study by Osborn *et al.*, 1990.[8] The first molar was included in the present study to exclude the variations that arise due to changes in tooth type and shape. The intra-examiner, inter-examiner and inter-probe analyses of sites with probing depths ≤4 mm revealed that there was no significant difference between the PPD and CAL measurement. The correlation coefficient between all variables was above 0.812 and *P* value was >0.05.

In sites with PPD >4 mm, the inter-examiner comparisons revealed that the correlation coefficient was above 0.863, i.e the variables had a positive correlation and the *P* value was above 0.601. Upon comparing PPD and CAL recorded by the same examiner in the two phases, the correlation coefficient was found to be above 0.795 which shows that the variables have a positive correlation and the *P* value was >0.05 except in PPD measured by the first examiner through CP. In that condition, the mean difference was 0.117 mm and *P* value was 0.025 which reveals the significant difference in the variables. The inter-probe comparisons revealed that in sites with probing depths ≤4 mm, the standard error of mean ranged from 0.006 to 0.025 and in sites with probing depths >4 mm, the standard error of mean varied from 0.047 to 0.056 and *P* value ranged from 0.00 to 1.692. The *P* value 0.00 reveals a significant difference in the inter-probe PPD measurements made by the first examiner in the second phase. The inter-probe analysis shows that the measurements taken by CP were on the higher side as compared to EP in sites with >4 mm pocket depth which is in agreement with few reported studies.[11,21,22] However, it contradicts with the findings of another study.[23] Kour *et al.* (2016) found that PD measured by CP was significantly more as compared to EP in healthy as well as diseased sites.[24] The reason behind this observation could be that CP overestimated the pocket depth recorded due to the nonstandardisation of force in more inflammatory conditions and the tip of the conventional probe tips usually penetrates the junctional epithelium and enters into the connective tissue attachment.[25] The depth of the periodontal pocket is directly related to the probing force.[26,27] Errors in manual recording and reading of markings of the CP may also influence the above finding.[25,28] However, other studies[10,29] demonstrated that the EP consistently undermeasured the probing depth and was less valid than CP but clinically acceptable. The explanations of this observation are that EP records less pocket depth due to less exploration of the bottom of the pocket and needs an alternative probe or explorer to detect calculus or evaluate root surface smoothness due to the lack of tactile senses.[30] Osborn *et al.*, 1992[10] suggested that the sleeve of the EP also interfered in the adaptation of the EP to the tooth surface.

In the present study, CEJ was used as a fixed reference point to measure the CAL as this method is simple, easy and involves no special equipment and the CEJ probe handpiece of EP has been designed especially to detect the CEJ which has a 0.125-mm prominent edge at the end of the sleeve that facilitates a "catch" of the CEJ. A stent was not used in the study because it has been reported that a stent does not influence the overall reproducibility of probing depths.[31] Although, Badersten *et al.*,[32] have reported in 1984 that, in comparison to using the CEJ as a reference, the use of occlusal stents results in improved reproducibility of CAL measurements. The results of the present study revealed that the correlation coefficient value was >0.850 and *P* value was >0.08 between the CAL measurements recorded with CP and EP. It means that no significant difference was found that was not consistent with the findings of Oringer *et al.*,[30] and Deepa and Prakash.[33] However, the comparison of studies is not quite feasible due to the different study designs including the prevailing conditions. Time, comfort, tooth type, tooth surfaces (i.e. facial, mesial, distal and palatal/lingual) and writing errors also influence the measurements taken by either probe that was not evaluated in the present study.

Quirynen *et al.*[34] reported that CP was slightly more reproducible and EP had the advantage of automatic registration that would overcome errors due to visual reading, manual transfer of data and bias during recording. Studies by Osborn *et al.*,[8,10] have shown that EP offers certain advantages in minimising errors in recording measurements for some clinical examiner whereas for others it does not necessarily result in less measurement error than the use of CP. CP had advantages in it was handy to use, economical and the probe can be walked in a pocket to find out the site with the deepest pocket whereas EP cannot walk circumferentially and is costly. EP requires longer clinical time and more practice to record data in the correct location in the chart.[35] It was also observed that probing was less painful in EP as compared to CP due to the standardization of force. In EP, the data were well maintained in computer which can be useful for long-term comparisons as well as patient education and motivation.[22] All probe types have some merits and demerits and they must be used based on the requirements for the clinical examination.

Conclusion

Within the limitation of the study, the present comparative study between the CP and CEJ probe of EP does not show a significant difference between the measurements except at some places in CP and the observations correlate well with each other. The results indicate that CP and EP both are reproducible and

accurate. It has been concluded that conventional probes are easy to use, simple and require no special equipment. Therefore, it is suggested to be used in routine periodontal examination whereas electronic probe is more likely to be useful for research purpose where long-term maintenance of data is a must for follow up evaluations. Further studies are required to evaluate the effect of time, comfort, tooth type, tooth surfaces (i.e. facial, mesial, distal, and palatal/lingual) and writing errors on the measurements taken by either probe. In the end, we would like to conclude that a dentist also should be a part of the team of primary care providers to improve the overall health of the family and community as well.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

The present work was funded by the Technology Development and Transfer Division, Department of Science and Technology, Government of India vide sanction letter no. DST/TSG/NTS/2013/47, dated 07 August 2014.

Conflicts of interest

There are no conflicts of interest.

References

1. Kornman KS, Crane A, Wang HY, di Giovine FS, Newman MG, Pirk FW, *et al.* The interleukin-1 genotype as a severity factor in adult periodontal disease. J Clin Periodontol 1997;24:72-7.
2. Armitage GC. American Academy of Periodontology, Research Science and Therapy Committee: "Diagnosis of periodontal diseases". J Periodontol 2003;74:1237–47.
3. Magnusson I, Fuller WF, Heins PJ, Rau CF, Gibbs CH, Marks RG, *et al.* Correlation between electronic and visual readings of pocket depths with a newly developed constant force probe. J Clin Periodontol1988;15:180-4.
4. Magnusson I, Clark WB, Marks RG, Gibbs CH, Manouchehr-Pour M, Low SB. Attachment level measurements with a constant force electronic probe. J Clin Periodontol 1988; 15:185-8.
5. Clark WB, Yang MCK, Magnusson I. Measuring clinical attachment: Reproducibility and relative measurements with an electronic probe. J Periodontol 1992;63:831-8.
6. Listgarten MA. Perodontal probing: What does it mean? J Clin Periodontol 1980;7:165-76.
7. Gibbs CH, Hirschfeld JW, Lee JG, Low SB, Magnusson I, Thousand RR, *et al.* Description and clinical evaluation of a new computerized periodontal probe-the Florida Probe. J Clin Periodontol 1988;15:137–44.
8. Osborn JB, Stoltenberg J, Huso B, Aeppli D, Pihlstrom B. Comparison of measurement variability using a standard and constant force periodontal probe. J Periodontol 1990;61:497-503.
9. Yang MCK, Marks RG, Clark WB, Magnusson I. Predictive power of various models for longitudinal attachment level change. J Clin Periodontol 1992;19:77-83.
10. Osborn JB, Stoltenberg JL, Huso BA, Aeppli DM, Pihlstrom BL. Comparison of measurement variability in subjects with moderate periodontitis using a conventional and constant force periodontal probe. J Periodontol 1992;63:283-9.
11. Rams TE, Slots J. Comparison of two pressure-sensitive periodontal probes and a manual periodontal probe in shallow and deep pockets. International J Periodont Rest Dent 1993;13:521-30.
12. Greenstein G. Contemporary interpretation of probing depth assessments: Diagnostic and therapeutic indications. J Periodontol 1997;68:1194-205.
13. Preshaw PM, Kupp L, Hefti AF, Mariotti A. Measurement of clinical attachment levels using a constant force periodontal probe modified to detect the cementoenamel junction. J Clin Periodontol 1999;26:434-40.
14. Karpinia K, Magnusson I, Gibbs C, Yang MC. Accuracy of probing attachment levels using a CEJ Probe versus traditional probes. J Clin Periodontol 2004;31:173-6.
15. Genco RJ, Sanz M. Clinical and public health implications of periodontal and systemic diseases: An overview. Periodontol 2000 2020;83:7–13.
16. Disale PR, Zope SA, Suragimath G, Varma AS, Pisal A. Prevalence and severity of periodontitis in patients with established rheumatoid arthritis and osteoarthritis. J Family Med Prim Care 2020;9:2919-25.
17. Khan MS, Alasqah M, Alammar LM, Alkhaibari Y. Obesity and periodontal disease: A review. J Family Med Prim Care 2020;9:2650-3.
18. Slots J. Primer on etiology and treatment of progressive/severe periodontitis. A systemic health perspective. Periodontol 2000 2020;83:272-6.
19. Beck JD, Papapanou PN, Philips KH, Offenbacher S. Periodontal Medicine: 100 Years of Progress. J Dent Res 2019;98:1053-62.
20. Bobetsis YA, Graziani F, Gürsoy M, Madianos PN. Periodontal disease and adverse pregnancy outcomes. Periodontol 2000 2020;83:154-74.
21. Caton J, Proye M, Polson A. Maintenance of healed periodontal pockets after a single episode of root planing. J Periodontol 1982;53:420-4.
22. Goodson JM, Kondon N. Periodontal pocket depth measurements by fiber optic technology. J Clin Dent 1988;1:35-8.
23. Mullaly BH, Linden GJ. Comparative reproducibility of proximal probing depth using electronic pressure-controlled and hand probing. J Clin Periodontol 1994;21:284-8.
24. Kour A, Kumar A, Puri K, Khatri M, Bansal M, Gupta G. Comparative evaluation of probing depth and clinical attachment level using a manual probe and Florida probe. J Ind Soc Periodontol 2016;20:299-306.
25. Polson AM, Caton JG, Yeaple RN, Zander HA. Histologic determination of probe tip penetration into gingival sulcus of humans using an electronic pressure-sensitive probe. J Clin Periodontol 1980;7:479-88.
26. Van der Velden U, De Vries JH. The influence of probing force on the reproducibility of pocket depth measurements. J Clin Periodontol 1980;7:414-20.

27. Caton J, Greenstein G, Polson AM. Depth of periodontal probe penetration related to clinical and histological signs of gingival inflammation. J Periodontol 1981;52:626-9.
28. Wang SF, Leknes KN, Zimmerman GJ, Sigurdsson TJ, Wikesjö UM, Selvig KA. Reproducibility of periodontal probing using a conventional manual and an automated force-controlled electronic probe. J Periodontol 1995;66:38-46.
29. Hull PS, Clerehugh V, Ghassemi-Aval VA. An Assessment of the validity of a constant force electronic probe in measuring probing depths. J Periodontol 1995;66:848-51.
30. Oringer RJ, Fiorellini JP, Koch GG, Sharp TJ, Nevins ML, Davis GH, *et al*. Comparison of manual and automated probing in an untreated periodontitis population. J Periodontol 1997;68:1156–62.
31. 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;14:407-11.
32. Badersten A, Nilvéus R, Egelberg J. Reproducibility of probing attachment level measurements. J Clin Periodontol 1984;11:475-85.
33. Deepa R, Prakash S. Accuracy of probing attachment levels using a new computerized cemento-enamel junction probe. J Ind Soc Periodontol 2012;16:74-9.
34. Quirynen M, Callens A, Van Steenberghe D, Nys M. Clinical evaluation of a constant force electronic probe. J Periodontol 1993;64:35-9.
35. Perry DA, Taggart EJ, Leung A, Newbrun E. Comparison of a conventional probe with electronic and manual pressure regulated probes. J Periodontol 1994;65:908-13.