

“PERIOBRAIN”: A NOVEL DIGITAL TOOL IN PERIODONTAL DIAGNOSIS

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ABSTRACT

Background: Periodontal disease is a prevalent condition in the general population. An updated classification system in 2018 introduced major changes to how this disease is classified and has implications for management. “PerioBrain” is a user-friendly digital periodontal diagnostic tool developed in English to assist dental healthcare professionals and students in establishing and verifying the classification of periodontal and peri-implant diseases. The current study aims to ascertain the accuracy and reliability in the assignment of case definitions of periodontal diseases according to the 2018 classification when a specialized mobile application is used to assist clinicians and dental students in formulating a diagnosis.

Materials and Methods: A comparative study was conducted by 26 dental interns on chronic periodontitis patients. The interns were trained in the 2018 AAP/EFP classification. 26 periodontal case records were utilized. Participants were allocated into two groups: a) Conventional diagnosis (n=13) and b) PerioBrain-assisted diagnosis (n=13). Diagnostic accuracy was assessed by comparison with the gold-standard diagnosis. Time required for diagnosis was recorded and perceived difficulty was assessed using a 5-point Likert scale. Statistical analysis was performed using IBM SPSS Statistics 26. A p-value < 0.05 was considered statistically significant throughout the analysis.

Results: Results demonstrated higher diagnostic accuracy and reduced diagnostic time in the PerioBrain-assisted group compared with the conventional group. Participants using PerioBrain also reported lower perceived difficulty scores. Statistical significance was assessed at p<0.05.

Conclusion: PerioBrain appears to be a promising adjunct tool in periodontal diagnosis.

Key Word: periobrain, digital tool

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INTRODUCTION

Periodontal disease is a prevalent condition in the general population. An updated classification system in 2018 introduced major changes to how this disease is classified and has implications for management. “PerioBrain” is a user-friendly digital periodontal diagnostic tool to establish and verify the classification of periodontal and peri implant diseases. “PerioBrain” have the potential to improve diagnostic standardization, enhance precision in disease classification and support prediction of disease outcomes.

MATERIAL AND METHODS

The study was conducted in the department of Periodontology, Sri Sidhartha dental college and Hospital. The research protocol was reviewed and accepted by the Institutional Ethical Committee (SSDCHIEC/2026/63). Written informed consent was obtained from all the participants in the study.

Study Design: Comparative study

Study Location: Department of Periodontology, Sri Sidhartha Dental College and Hospital, Tumkur, Karnataka

Study Duration: 1 month

Sample size: 26

Sample size calculation: The sample size was estimated using the single population proportion formula based on the overall diagnostic accuracy of 84% reported in the reference study.

Sample size is estimated by using this formula :

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:

Z=1.96 (95% confidence interval)

p=0.84

q=1-p=0.16

d=15%=0.15

Substituting the values:

$$n = \frac{(1.96)^2 \times 0.84 \times 0.16}{(0.15)^2}$$

$$n = \frac{3.8416 \times 0.1344}{0.0225}$$

$$n = \frac{0.5167}{0.0225}$$

$$n = 22.96$$

Therefore, the minimum required sample size is 23 participants.

Adding a 10% contingency for possible dropouts or incomplete data: n

$adjusted = 23 + (23 \times 0.10) = 25.3$

The final sample size is rounded up to 26 participants.

Subjects & selection method:

Inclusion criteria for participants:

1. Dental interns willing to participate in the study
2. Dental interns who have undergone formal training in the 2018 AAP/EFPP Classification on periodontal and peri-implant diseases.

Exclusion criteria for participants:

1. Dental interns who are unwilling to participate in the study
2. Interns who have previously used or are extensively familiar with the “PerioBrain” application
3. Incomplete participation in either diagnostic session

Inclusion criteria for patients:

- a) All periodontitis patients of age group 20-60 years who gave informed consent to participate in the study
- b) Cases with adequate diagnostic information for periodontal classification

Exclusion criteria for patients: -

- a) Patients who didn't give informed consent to participate in the study
- b) Patients with insufficient diagnostic findings
- c) Patients undergoing active periodontal treatment at the time of evaluation
- d) Patients who underwent periodontal treatment from past 6 months

Methodology

A total of 26 patient case records were selected from the dental outpatient section after taking informed consent. To ensure an equal baseline of diagnostic difficulty, these 12 cases were cross-matched into pairs based on clinical complexity. The examiner evaluated all records beforehand to establish the "Gold Standard" diagnosis (staging and grading according to the 2018 classification) for final comparison. All the interns willing to participate in the study were given training on 2018 AAP/EFPP classification of periodontal and peri-implant diseases.

Group Allocation: The interns were divided into two equal groups (N=26):

- a) Group 1 (Conventional Method, n=13): Interns diagnosed 13 assigned cases using conventional method (case history details and

printed charts of the 2018 classification system)

- b) Group 2 (Mobile App Assisted, n=13): Interns diagnosed the remaining 13 matched cases utilizing the "PerioBrain" mobile application to assist their diagnostic workflow.

The conventional method of periodontal diagnosis

– Conventional method refers to the traditional diagnostic workflow. Interns manually reviewed the patient's clinical case history (including probing pocket depths, clinical attachment loss, bleeding on probing, and radiographic bone loss) and formulated a diagnosis, stage, and grade by relying on memory or printed text reference charts of the 2018 AAP/EFPP World Workshop Classification, without the aid of any digital diagnostic applications.

Parameters Evaluated:

Diagnostic Accuracy: The percentage of interns' diagnoses that exactly match the faculty Gold Standard.

Time Efficiency: The total time taken (in minutes/seconds) per case, recorded using a digital stopwatch.

Perceived Difficulty: A post-diagnostic survey using a 5-point Likert scale to assess how difficult the interns found the diagnostic process.

5-point Likert scale:

- 1 – very easy
- 2 – easy
- 3 – moderate
- 4 – difficult
- 5 – very difficult

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were expressed as frequencies and percentages for categorical variables and as mean $\pm$ standard deviation (SD) for continuous variables. The distribution of perceived diagnostic scores and diagnostic accuracy between the Conventional and PerioBrain App groups was assessed using the Chi-square test of independence. Yates' continuity correction was applied for the analysis of diagnostic accuracy because of the 2×2 contingency table structure. Comparison of mean diagnostic time between groups was performed using the Independent Samples t-test. Diagnostic velocity (diagnoses per hour) was compared using Welch's t-test to account for unequal variances between groups. All statistical tests were two-tailed, and a p-value less than 0.05 was considered statistically significant. The level of significance was set at 95% confidence interval throughout the analysis.

RESULT

Table no 1

Chi-Square Test Comparing Perceived Scores Between Groups

Perceived Score	Conventional Group (n=13) n (%)	Periobrain App Group (n=13) n (%)	χ^2	p
1	0 (0.0)	5 (38.5)	26.00	< .001
2	0 (0.0)	8 (61.5)		
3	2 (15.4)	0 (0.0)		
4	7 (53.8)	0 (0.0)		
5	4 (30.8)	0 (0.0)		

The distribution of perceived diagnostic scores showed a significant difference between the Conventional Group and the Periobrain App Group. In the conventional group, 7 participants (53.8%) reported a score of 4, 4 participants (30.8%) reported a score of 5, and 2 participants (15.4%) reported a score of 3. In contrast, none of the participants in the Periobrain App group reported scores of 3, 4, or 5; instead, 5 participants (38.5%) reported a score of 1 and 8 participants (61.5%) reported a score of 2. The Chi-square test revealed a highly significant association between diagnostic method and perceived score distribution ($\chi^2 = 26.00$, $df = 4$, $p < .001$), indicating a marked difference in participant perceptions between the two diagnostic approaches.

Figure 1

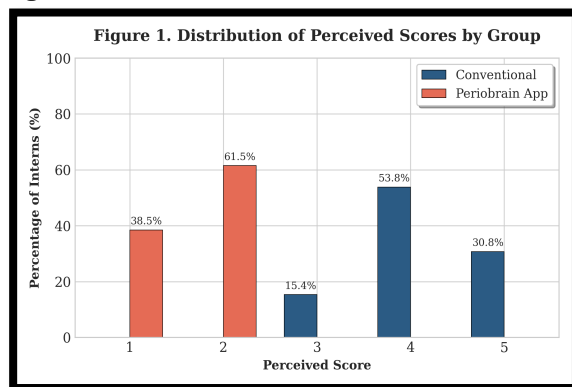


Table 2
Comparison of Diagnostic Accuracy Between Groups

Accuracy	Conventional Group (n=13) n (%)	Periobrain App Group (n=13) n (%)	χ^2	p
Correct	3 (23.1)	13 (100.0)	13.16	< .001
Incorrect	10 (76.9)	0 (0.0)		

Note. N = 26. $df = 1$. Yates' continuity correction applied.

Diagnostic accuracy was significantly higher in the Periobrain App Group compared with the Conventional Group. In the conventional group, only 3 participants (23.1%) achieved a correct diagnosis, while 10 participants (76.9%) made an incorrect diagnosis. In contrast, all 13 participants (100.0%) in the Periobrain App group correctly diagnosed the condition, with no incorrect diagnoses recorded. Chi-square analysis with Yates' continuity correction demonstrated a highly significant difference between groups ($\chi^2 = 13.16$, $df = 1$, $p < .001$), confirming the superior diagnostic accuracy achieved using the Periobrain application.

Figure 2

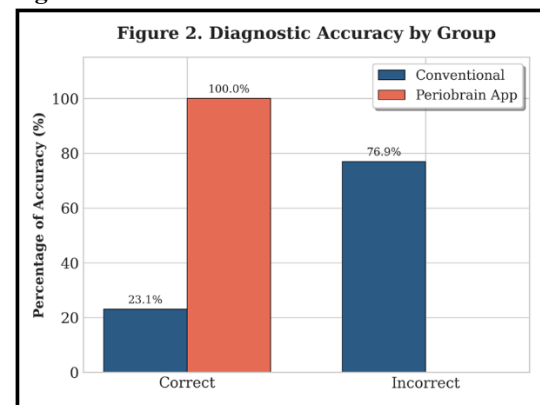


Table 3

Independent Samples t-Test for Time Taken (Seconds)

Group	n	M	SD	t	p
Conventional Group	13	780.0	233.6	11.80	< .001
Periobrain App Group	13	14.92	4.17		

Note. N = 26. $df = 24$. Time is measured in seconds. A substantial reduction in diagnostic time was observed among participants using the Periobrain App. The conventional group required a mean time of 780.00 ± 233.67 seconds to complete the diagnosis, whereas the Periobrain App group required only 14.92 ± 4.17 seconds. Independent samples t-test analysis demonstrated that this difference was highly statistically significant ($t = 11.80$, $df = 24$, $p < .001$). These findings indicate that the Periobrain App reduced the time required for diagnosis by more than fifty-fold compared with the conventional diagnostic approach.

Figure 3

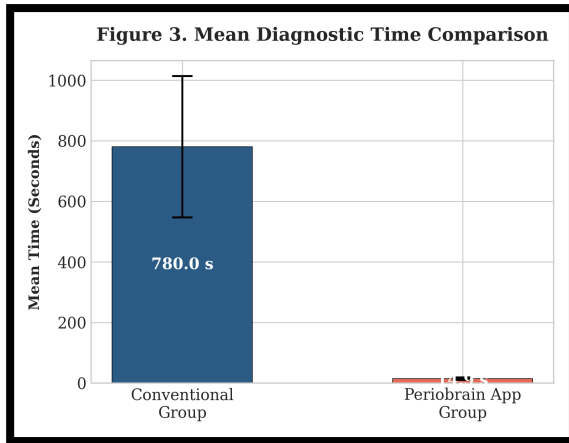


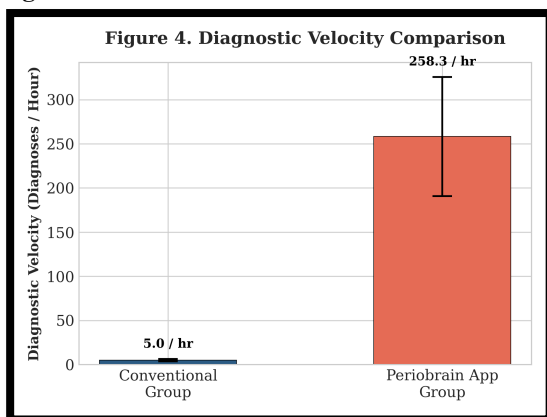
Table 4
Independent Samples Welch t-Test for Diagnostic Velocity (Diagnoses per Hour)

Group	n	M	SD	t	p
Conventional Group	3	4.98	1.38	13.5	< .001
Periobrain App Group	3	258.2	67.4		

Note. N = 26. Velocity calculated as 3600 / Time(s). Welch's t-test used due to unequal variances.

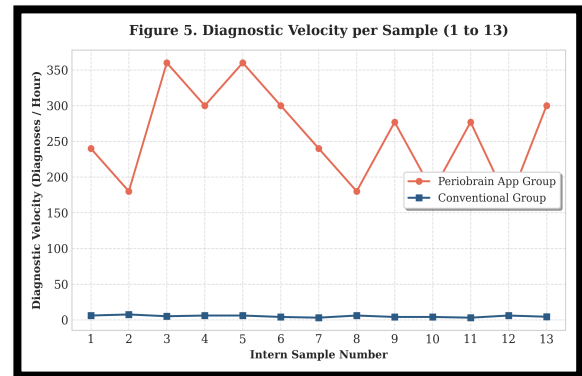
Diagnostic velocity analysis revealed a dramatic improvement in performance among participants using the Periobrain App. The conventional group achieved a mean diagnostic velocity of 4.98 ± 1.38 diagnoses per hour, whereas the Periobrain App group achieved a mean velocity of 258.27 ± 67.47 diagnoses per hour. Welch's t-test demonstrated a highly significant difference between groups ($t = 13.53$, $p < .001$). The results indicate that the Periobrain App enabled participants to perform approximately 52 times more diagnostic assessments per hour than the conventional diagnostic method.

Figure 4



Individual Sample Velocity Comparison

Figure 5 below illustrates the individual diagnostic velocity (calculated as diagnoses completed per hour) for each of the 13 interns across both diagnostic methodologies. The line graph highlights the consistent and profound acceleration achieved by all interns when utilizing the Periobrain application.



The individual diagnostic velocity graph demonstrated a consistent increase in performance for all 13 interns when using the Periobrain App. While diagnostic velocities in the conventional approach clustered around a mean of 4.98 diagnoses per hour, velocities with the Periobrain App increased markedly, averaging 258.27 diagnoses per hour. Every participant showed a substantial upward shift in diagnostic velocity, indicating that the benefits of the application were experienced uniformly across all users. This consistent improvement supports the reliability and effectiveness of the Periobrain App as a clinical decision-support tool for enhancing diagnostic efficiency and productivity.

DISCUSSION

The 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions was organized jointly by the European Federation of Periodontology (EFP) and the American Academy of Periodontology (AAP) (Caton et al., 2018). Implementing these newer classification systems in clinical practice and research demands adequate training and time to overcome the associated learning curve.

Although extensive efforts have been made to disseminate the system, studies indicate inconsistencies and inaccuracies in assigning periodontal case definitions using the new classification criteria (Marini et al., 2021; Kakar et al., 2022). A correct diagnosis is essential to dictate appropriate, evidence-based treatment decisions (Herrera et al. 2022). The inability of clinicians to consistently establish a correct diagnosis may lead to inappropriate therapies, ineffective communication with patients and members of the dental team, and delayed referral to secondary treatment centers (Jayawardena et al. 2021).

“PerioBrain” is a user-friendly digital periodontal diagnostic tool developed in English to assist dental healthcare professionals and students in establishing and verifying the classification of periodontal and peri-implant diseases. The current study aimed to ascertain the accuracy and reliability in the assignment of case definitions of periodontal diseases according to the 2018 classification when a specialized mobile application is used to assist clinicians and dental students in formulating a diagnosis.

Brian Maloney et al in the year 2025 conducted a study on the value of using a novel mobile application as an adjunct to the traditional method of diagnosing periodontal diseases. This novel research aimed to determine the level of accuracy and reliability in the assignment of case definitions of periodontal diseases according to the 2018 classification using a specialized mobile application. The study found a high level of diagnostic accuracy and consistency in periodontal disease diagnosis when diagnostic software was used as an adjunct to assigning case definitions. This is in accordance with the results of the present study.¹

Higher diagnostic accuracy and reduced diagnostic time was found in periobrain-assisted group compared to the conventional group. Participants using periobrain app also reported lower perceived difficulty scores.

Sanchez et al in the year 2022 conducted study on the development and testing of a mobile application for periodontal diagnosis. The objective of this study was to develop and test the implementation of a mobile device application for periodontal diagnosis. Participants were asked to determine the diagnosis of 10 predetermined clinical cases using two strategies: diagnosis based on knowledge and with the PerioSmart application. The study found that mobile device application demonstrated efficiency and good concordance rate and therefore can improve the periodontal diagnosis. The results are in accordance with the present study as it was found that participants using periobrain application demonstrated higher diagnostic accuracy.²

CONCLUSION

Periobrain appears to be a promising digital adjunct for periodontal diagnosis. By improving diagnostic accuracy, efficiency, and user confidence, it supports the principles of predictive, preventive and precision dentistry through more accurate disease classification, earlier intervention and personalized treatment planning.

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