Accuracy of Novel Simplified Periodontal Classification Infographic for Periodontal Diagnosis Among a Group of Thai Dental Students

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Abstract

Objective: To compare the accuracy of periodontal diagnosis using the novel simplified periodontal classification infographic between preclinical and clinical dental students in a group of Thai dental students.

Method: This randomized crossover study included 84 preclinical and clinical dental students from a private dental school in Pathum-Thani, Thailand. They were assigned to diagnose 20 periodontal cases using the proceeding of periodontal diseases and conditions (AAP/EFP 2018) and novel simplified periodontal classification infographic. Twenty fully documented periodontal cases, which had been diagnosed according to new periodontal classification and achieved 100% agreement by three experienced periodontists, were prepared for questionnaires in digital format. Prior to answer questionnaires, 21 participants of each group were assigned to study the proceeding and other 21 participants from each group were designated to learn periodontal classification infographic. After learning period, questionnaires of 20 cases were complete submitted. Subsequently 1 month of wash-out period, all participants were alternated to read opposite side of periodontal classification documents and answer these questionnaires again.

Results: After implementation, clinical group were able to diagnose periodontal health cases, gingivitis cases and identify stage and grade of periodontitis significantly higher than preclinical group. Both groups had a significantly increased in accuracy of diagnosis after using novel simplified periodontal classification infographic.

Conclusion: This novel simplified periodontal classification infographic is an effective tool to improve accuracy of periodontal disease diagnosis for both preclinical and clinical dental students.

Keywords: Infographic, Periodontal classification, Periodontal diagnosis

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Introduction

The Proceeding of the new periodontal classification 2018 was developed and published according to 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions by European Federation of Periodontology (EFP) and American academy of Periodontology (AAP). It was aimed to identify well-defined clinical entities using a clear criterion that linked periodontal diagnosis and treatments based on a thorough evaluation of the scientific evidence (1). This new classification system encompasses a multidimensional view of periodontitis by using staging and grading which consider patient's overall health status and risk factors (2). As well as the sign of bleeding on probing was recognized as the primary clinical parameter to classify gingival health and gingival inflammation which occurring on an intact periodontium or on a reduced periodontium, in whom attachment not loss due to periodontitis (3).

Nevertheless, it is challenging for the clinicians, especially the dental students who do not experience to diagnose periodontal diseases, to apply the new periodontal classification to clinical practice. The reasons being was that the new periodontal classifications are very detailed to be used in making a prompt diagnosis in the clinician's daily basis (4). In 2019, Thai Association of Periodontology proposed the novel simplified periodontal classification infographic aimed to simplify and encourage the clinician to adopt the new periodontal classification (5).

This infographic was refined by systematically summarize the 2018 proceeding of the Classification of Periodontal and Peri-Implant Diseases and Conditions straight forwardly using a few infographics and focused on periodontal health and common periodontal diseases, which not including peri-implant diseases and conditions. Briefly, the infographic composes of two pages and three steps for periodontal diagnosis, starting from identify non-periodontitis patient from periodontitis patient according to definition and exclusion criteria of new periodontal classification AAP/EFP 2018. The non-periodontitis patients including clinical gingival health and gingivitis, which both conditions can occur on an intact periodontium or on a reduced periodontium, will be differentiated by using percentage of bleeding on probing. The periodontitis patients will be further diagnosed and analyzed extent, stage and grade in accordance with clinical attachment level, complexity shifter and rehabilitation situations (5). The application of the novel simplified periodontal classification infographic in dental students was adopted by some dental schools in Thailand. However, the scientific evidence of the accuracy of the novel simplified periodontal classification infographic implementation is limited. This study purposed to evaluate the accuracy of diagnosis when using periodontal classification infographic for periodontal diagnosis among a group of Thai dental students.

Materials and Methods

This randomized crossover study was approved by the Ethic committee on human experiment of Research Institute of Rangsit University (RSUERB 2022-055). The informed consent was obtained from all eligible participants, and all personal information confidentiality were assured. The total of 84 participants including 42 pre-clinical dental students who studying in 4^{th} academic year and 42 clinical dental students who studying in 5^{th} or 6th academic year and

had about 1 year of clinical experience. All were randomly recruitment in this study. The inclusion criteria were that participants who currently study at college of dental medicine, had attended and passed the examination of the periodontal class about the new periodontal classification 2018, which held on 1st semester of 4th academic year, and could participate throughout the whole study. All of participants unprecedented about the novel simplified periodontal classification infographic before.

The full documentation of 20 periodontal cases used in this study were gathered in the manner of routine practice in the comprehensive care clinic from January 2021 - April 2022 at College of Dental Medicine, Rangsit University, Thailand. The baseline documentation of these 20 cases presented information as following:

1. Age and gender
2. General medical history including smoking habit and glycemic level
3. Dental history including history of tooth loss due to periodontitis
4. Radiographic examination including panoramic radiographs and full month periapical radiographs
5. Periodontal chart including periodontal probing depth, gingival margin level, clinical attachment level, degree of furcation involvement (Hamp's classification), degree of tooth mobility and bleeding on probing

The entire documentation of 20 periodontal cases had achieved 100% agreement of the diagnosis by three experienced periodontists according to proceeding of the Classification of Periodontal and Peri-Implant Diseases and Conditions (1,2,3,6,7,8). These periodontal cases included 4 periodontal health which consisted of 2 on an intact periodontium, 2 on a reduced periodontium; 4 gingivitis cases that consisted of 2 on an intact periodontium and 2 on a reduced periodontium; and 12 cases of staging and grading in equally proportionated. The documentation of 20 cases were provided to participants in digital format as questionaries with 4 choices of each question.

The eligible participants were equally allocated into two groups:

Group A: included 42 preclinical dental students

Group B: included 42 clinical dental students

The study processed in 2 sessions. For each session, the participants in group A and B were equally divided into

Group A1 (n = 21) and group B1 (n = 21): assigned to read the original proceeding periodontal classification 2018

Group A2 (n = 21) and group B2 (n = 21): assigned to use the novel simplified periodontal classification infographic

The first session, each participant had one week period for study their assignment. After implementation, all participants had to diagnose the 20 prepared periodontal cases, and individual scores were collected. Before starting the second session, the participant received a one-month washout period aimed to distance themselves from the questionnaires.

The second session, all the participants were swapped into another groups. The participants who were the members of group A1 and B1 originally reading proceeding of periodontal classification 2018 were reallocated to group A2 and B2 for using the novel simplified periodontal classification infographic as their second implementation. The same process was conducted

to prior groups A2 and B2 which to be reassigned in the second session as group A1 and B1 for reading proceeding of periodontal classification 2018. All participants had to diagnose repeatedly the 20 periodontal cases, and individual scores were collected (Fig 1).

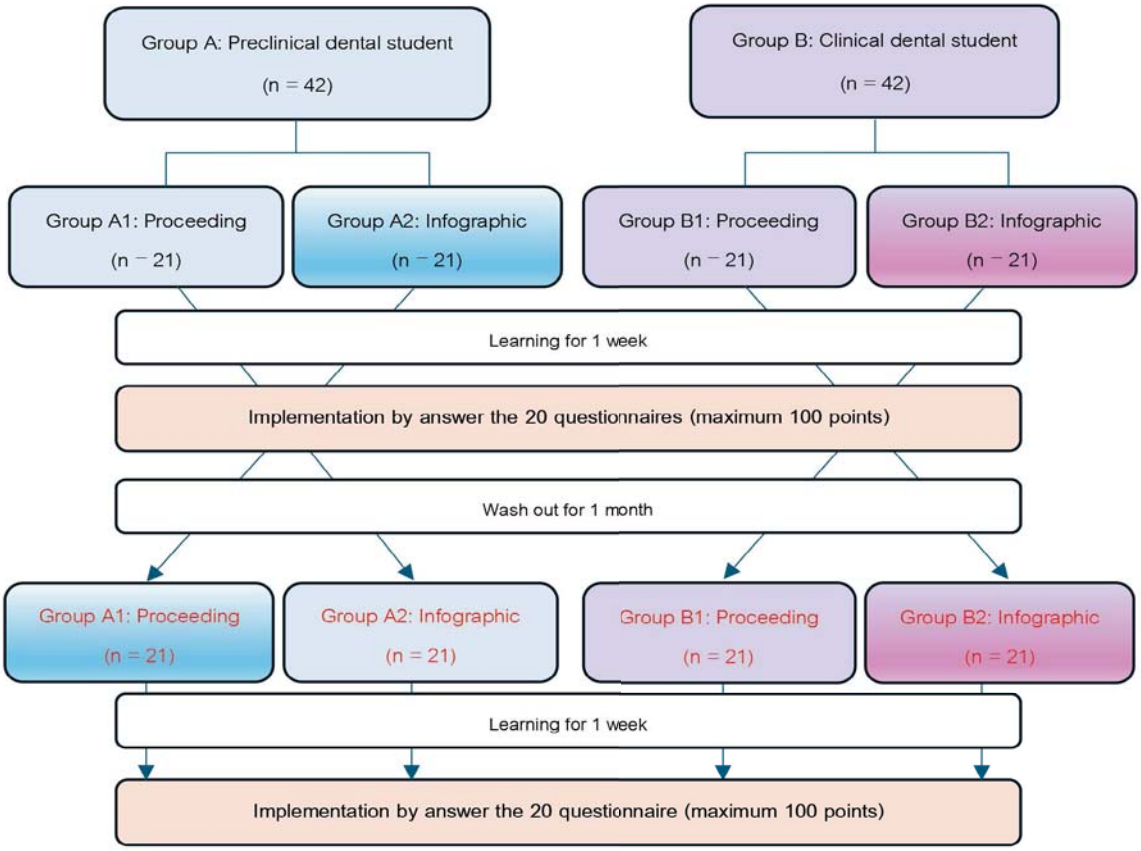

Fig 1. Flow chart summarized the procedure of each implementation across four groups.

Statistical analysis

The standard deviation, mean, median, maximum, and minimum, although a one-tailed t-Test ($\alpha = 0.05$) were used in descriptive and inferential statistics to determine a significant difference between the means of all examination scores before and after the use of infographic underlying factors. The Mann-Whitney U test was utilized to compare the differences between the two independent groups when the dependent variables were either ordinal or continuous. And for the paired samples, the Wilcoxon signed-rank test was used to compare paired data. The SPSS 28.0.1 program (SPSS: An IBM Company, New York, USA) was used to perform the data analysis.

Results

The eighty-four participants, including 42 preclinical dental students and 42 clinical students, completed 2 sessions of periodontal cases questionnaires. The comparison in the differences of scores before and after the implementation of the periodontal infographic was analyzed as followed:

1. Comparison of the differences in the accuracy of periodontal diagnosis overall scores between the preclinical and clinical groups: after the implementations of the proceeding and infographic, the clinical group (Group B) were particularly able to identify all periodontal conditions more accurately than the preclinical group (Group A) statistically significant ($p < 0.05$). The clinical group (Group B) showed a statistical significance ($p < 0.001$) in the accuracy of diagnosis for Gingivitis, Periodontitis, Stage and Grade than the preclinical group (Group A) as shown in Table 1.

Table 1. The accuracy of the periodontal diagnosis and disease identification by the group.

Periodontal diagnosis		Preclinical groups (n = 42)		Clinical groups (n = 42)		p*
Periodontal health (8 points)	Mean (SD)	4.88	(2.04)	5.67	(2.36)	0.006**
	Median (IQR)	4.00	(4.0 - 6.0)	6.00	(4.0 - 8.0)	
Gingivitis (8 points)	Mean (SD)	3.69	(2.02)	5.57	(1.81)	< 0.001**
	Median (IQR)	4.00	(2.0 - 4.0)	6.00	(4.0 - 8.0)	
Periodontitis (24 points)	Mean (SD)	20.10	(3.86)	22.02	(2.79)	< 0.001**
	Median (IQR)	22.00	(18.0 - 23.0)	24.00	(20.0 - 24.0)	
Stage (12 points)	Mean (SD)	6.00	(2.16)	7.76	(2.75)	< 0.001**
	Median (IQR)	6.00	(5.0 - 7.0)	8.00	(6.0 - 10.0)	
Grade (12 points)	Mean (SD)	4.60	(2.11)	7.33	(2.64)	< 0.001**
	Median (IQR)	5.00	(3.0 - 6.0)	7.50	(5.0 - 9.0)	

SD, standard deviation; IQR, Interquartile range

*p-value compared between using preclinical and clinical (Mann-Whitney U test)

**Significant at $p < 0.05$

2. Comparison of the differences in the accuracy of periodontal diagnostic scores between and within the preclinical and clinical groups after implementation of proceeding and infographic

Accuracy of the full diagnosis: The percentage of accuracy as 80.00 and 86.31 were presented in clinical group, as well the preclinical group able to receive the accuracy of 70.24% and 73.10% after reading the proceeding and after implementation of infographic respectively. Both groups exhibited a statistical significance increase in diagnostic score after implementation of periodontal infographic ($p^{‡} < 0.05$) compared to reading the proceeding. The results revealed that clinical group was able to diagnose periodontal conditions better than preclinical group statistically significant after reading the proceeding and implementation of infographic ($p^{*} < 0.05$, $p^{†} < 0.05$ respectively) as shown in fig 2.

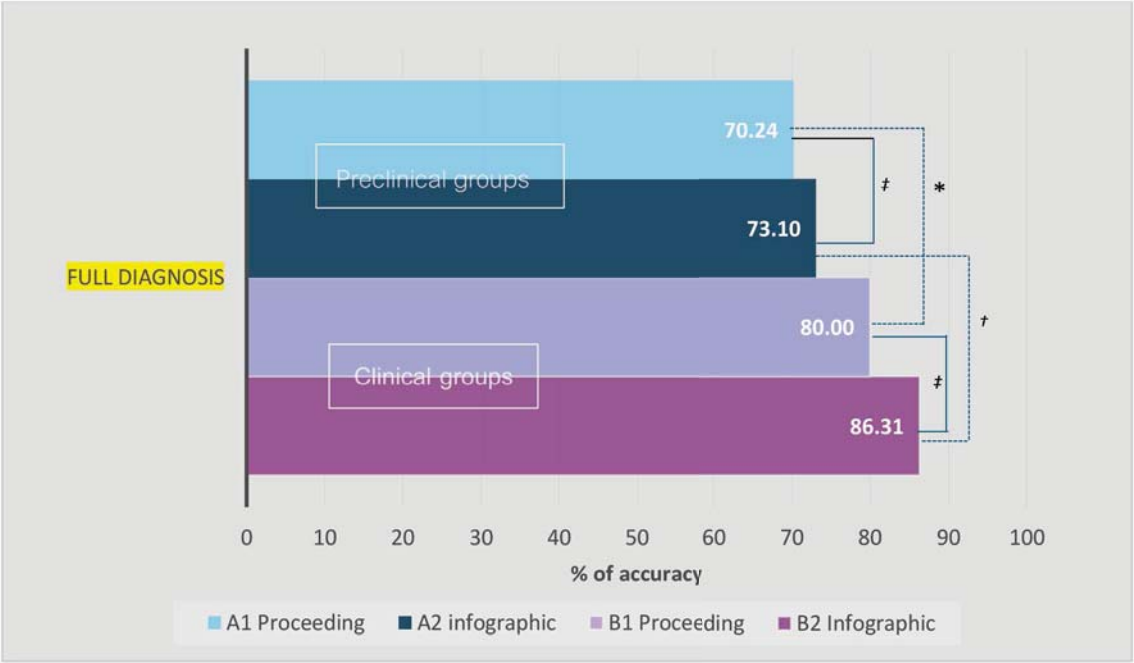

Fig 2. The percentage of accuracy after implementation of reading proceeding/ infographic for full diagnosis across four groups.
$p^{*} < 0.05$ compared proceed between preclinical group and clinic group
$p^{†} < 0.05$ compared info between preclinical group and clinical group
$p^{‡} < 0.05$ compared within the same group of dental students between using proceeding and infographic

Accuracy of disease identification: The questionnaires were categorized as periodontal health, gingivitis and periodontitis as mentioned before. The mean of accuracy in each category was present in fig 3-5.

The preclinical group as well as clinical group exhibited a higher mean diagnostic score of periodontal health after the implementation of the periodontal infographic than after the implementation of proceeding statistically significant ($p^{‡} < 0.05$). The mean diagnostic score of periodontal health on a reduced periodontium was lowest in group A1, as 0.71, whereas group A2 and B2 presented the same mean score as 0.93. When focusing on periodontal health diagnosis, group B2 shown the highest mean score (6.24) than other groups statistically significant ($p^{*} < 0.05$) (Fig 3).

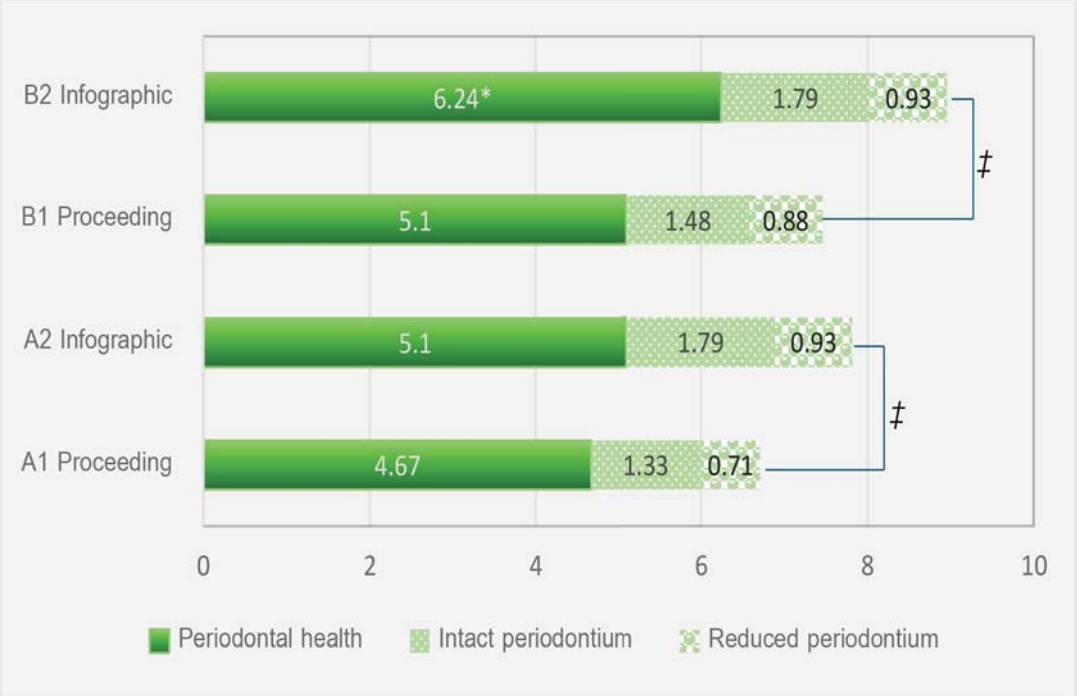

Fig 3. The mean diagnostic score after implementation of reading proceeding/ infographic for periodontal health categories across four groups. ($p^{‡} < 0.05$ compared within the same group, $p^{*} < 0.05$ compared between groups)

In category of gingivitis, the mean diagnostic score within clinical groups (B1 and B2) were not statistically significant difference. But in preclinical groups, the infographic group (A2) presented a higher mean diagnostic score of gingivitis compared to proceeding group (A1) statistically significant at $p^{‡} < 0.05$ (mean score 4.29 and 3.10 respectively). Group A1 presented the statistical significance lowest mean diagnostic score (1.02) for gingivitis on an intact periodontium compared to other groups. On the contrast, group A2 exhibited the statistical significance lowest mean diagnostic score (0.24) for gingivitis on a reduced periodontium (Fig 4).

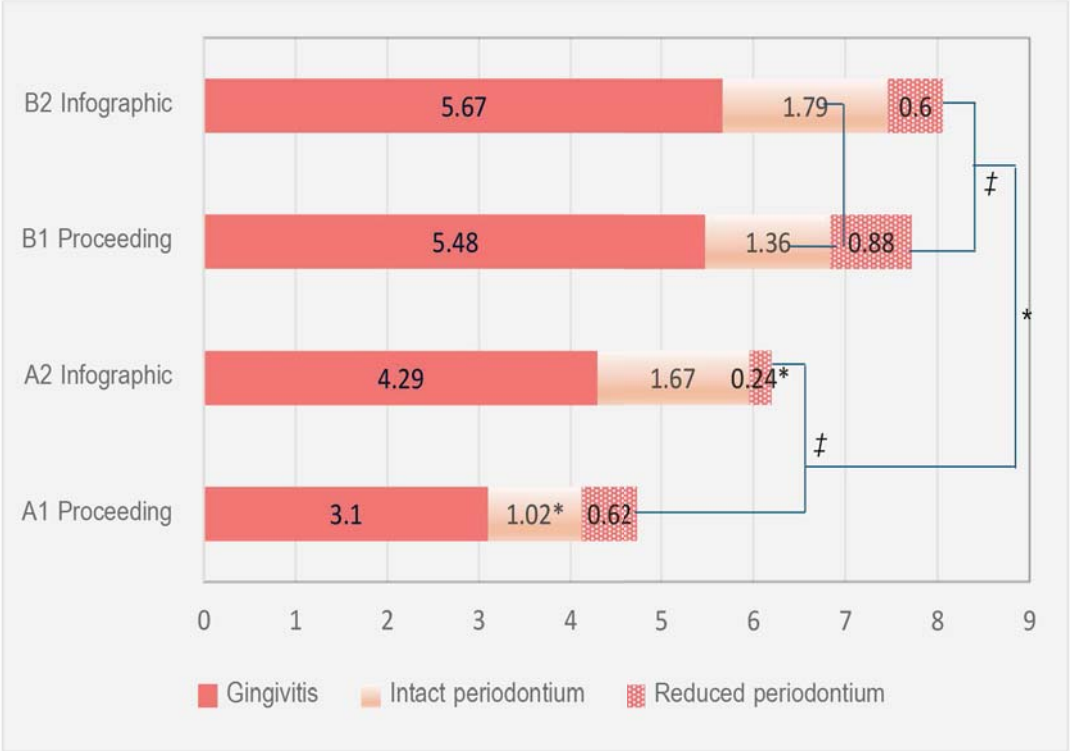

Fig 4. The mean diagnostic score after implementation of reading proceeding/ infographic for gingivitis category across four groups. ($p^{‡} < 0.05$ compared within the same group, $p^{*} < 0.05$ compared between groups)

In category of periodontitis, the mean diagnostic score for periodontitis was not statistically significant among four groups. Nevertheless, after the implementation of infographic both preclinical groups and clinical groups shown a higher mean diagnostic score for grade identification than after the implementation of proceeding statistically significant at $p^{‡} < 0.05$ (5.07 vs 4.12 and 8.36 vs 6.31 respectively). After implementation of infographic in clinical group (B2) revealed the highest mean diagnostic score for stage identification (9.17) when compared to other groups at $p^{*} < 0.05$. (Fig 5).

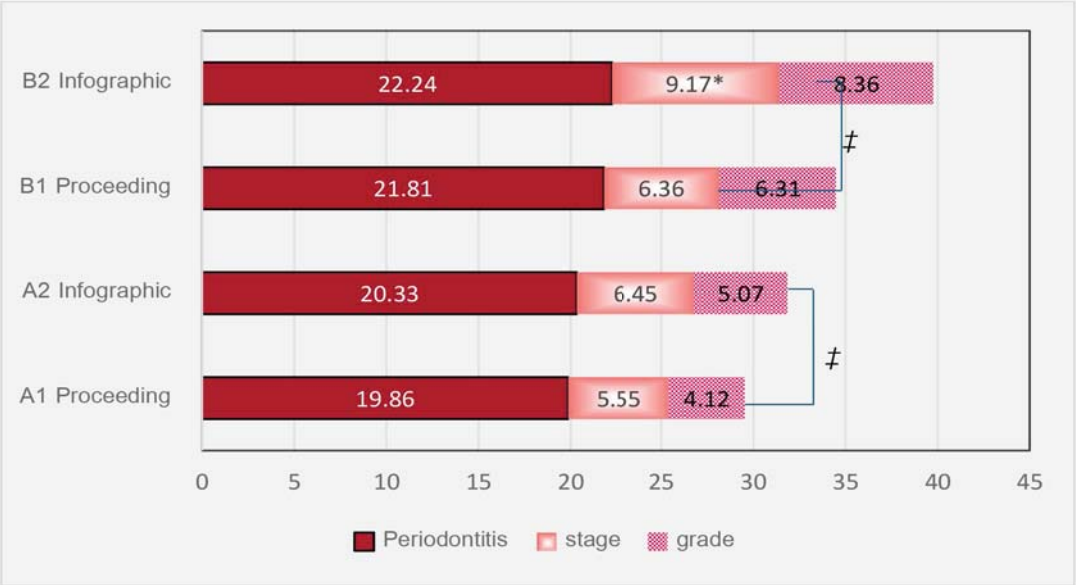

Fig 5. The mean diagnostic score after implementation of reading proceeding/ infographic for periodontitis category across four groups.
($p^{‡}$ < 0.05 compared within the same group, p* < 0.05 compared between group.

Discussion

In 2019, the novel simplified periodontal classification infographic was evolved and published by Thai Association of Periodontology (5). The authors designed this infographic to efficiently differentiate between the three most common periodontal conditions: Periodontal health, Gingivitis and Periodontitis for quick initial evaluation of periodontal diseases and assist clinicians to provide better patient-specific care. Nonetheless, there was no study that provide the data about the accuracy of this periodontal classification infographic after implementation.

This study intended to assess the accuracy of using the novel simplified periodontal classification infographic compared with the reading of proceeding periodontal classification 2018 among a group of dental students. In certain instances, positive results shown in both preclinical and clinical groups after implementing the infographic. Furthermore, preclinical group responded in higher score of periodontal health diagnosis and gingivitis on an intact periodontium cases after implementation of infographic than the reading of proceeding group. However, they were able to diagnose the gingivitis on a reduced periodontium cases more accurately after implementation of reading the proceeding. This might be due to the participants utilizing the infographic for the first time not being aware that a reduced periodontium from non-periodontitis has occurred since the procedure has provided greater depth and explanation to the diagnosis of each categorization. Comparatively to the preclinical group, the clinic group had a better grasp of the new periodontal categorization and greater expertise in applying

this new classification to reach a clinical periodontal diagnosis. Meanwhile, the clinical group can utilize the infographic to aid in the diagnosis of cases with a considerable escalating score in disease identification, periodontium status, staging, and grading of periodontitis.

This perception result was comparable to that of prior study that the significantly higher scores were also discovered in research analyzing a flowchart for the new periodontal classification of 2018, that is utilized by periodontists, first-, second-, and third-year postgraduate students in Periodontology, as well as fifth-year dental students (9). These findings were in line with our study; employing flowcharts reduced the number of periodontitis patients that were incorrectly diagnosed. To assign a diagnosis based on the 2018 periodontal classification, the flowcharts increased the physicians' confidence. Another study by Parsegian et al., which periodontal classification flowchart was utilized by twenty-six second year dental hygiene students (DHS2) and predoctoral dental students (DS) in their second, third, and fourth years (DS2, DS3, DS4), respectively (10). The study contained ten periodontal clinical cases, and the students were divided into two groups: the control group, who were only permitted to apply their curriculum-based knowledge, and the test group, who were given a flowchart to help them diagnose periodontal disease. The result revealed that the combined test groups significantly outperformed controls in terms of accuracy in diagnosing periodontal conditions (73.5% vs. 50.0%, respectively), with the most notable improvements seen in the DS2 (66.3% vs. 30%, respectively) and DHS2 (70.0% vs. 41.4%, respectively) test groups. Additionally, when flowcharts were employed, diagnosis accuracy considerably increased with more years of DS training, which is comparable to our research finding that clinical students greatly outperform preclinical students in accurately diagnosing periodontal situations.

The novel simplified periodontal classification was partially adapted from the proceeding of periodontal diseases and conditions 2018 which contains a substantial amount of evidence-based information. As the flowcharts or infographic were made for use as a quick initial screening process based on the three most common periodontal conditions, it may possess some limitations. Some other periodontal diseases and conditions such as non-biofilm induced gingival disease, necrotizing periodontal diseases, periodontitis as a manifestation of systemic diseases and other conditions affecting the periodontium are not included in the novel simplified periodontal classification. Thus, it cannot be assumed that this infographic represents the entire periodontal classification of periodontal diseases and conditions. Therefore, to make an accurate diagnosis, it is necessary to thoroughly study the proceeding of periodontal diseases and conditions 2018 in conjunction with clinical experience to ensure the definitive diagnosis.

The study and scientific data which connect periodontal classification flowchart and infographics to patient diagnosis is limited. It is suggested that future research should look at how this infographic might be used in general practitioner dentists or other clinical expertise.

Conclusion

The novel simplified periodontal classification infographic is an effective tool that could improve the efficiency and accuracy of periodontal diseases diagnosis which respect to the new classification of AAP/EFP 2018. Dental education and dental students may adopt this periodontal infographic for clinical practice to enable a straightaway diagnosis of periodontal diseases and conditions.

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