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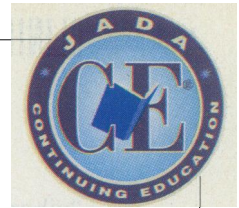
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AN ACCURATE, TIME-EFFICIENT METHOD TO ASSESS PLAQUE ACCUMULATION

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ABSTRACT

The authors compared the accuracy and time efficiency of a simplified index called the Plaque Assessment Scoring System, or PASS, and the O'Leary Plaque Control Record. Using both indexes, they examined 35 participants. They found a strong correlation between the results achieved with each method. They also noted that the mean time required to complete the PASS examination was considerably less than that needed to record the O'Leary index, 1.47 vs. 7.07 minutes, respectively.

It has long been established that the central etiological agent of periodontal disease is bacterial plaque.^{1,2} Without the presence of plaque, other risk factors become inconsequential. Successful outcomes with either nonsurgical or surgical treatment must center around the elimination of plaque.³

Practitioners in every practice setting understand the crucial need for oral hygiene documentation and instruction. Unfortunately, plaque control is not routinely evaluated. When it is addressed, it usually is described in subjective terms like "good," "fair" or "poor." The obvious reason for this subjective approach to evaluating plaque control is that it saves time.

The literature describes many plaque index systems used in clinical research, but they are complicated and time-consuming. The most frequently used is the Silness and Loe Plaque Index, which assesses the surface area and thickness of plaque from grades of 0 to 3.^{4,5} There are four other indexes commonly used in clinical studies. The Simplified Oral Hygiene Index by Greene and Vermillion is based on the surface area of the tooth covered with plaque.⁶ The Modified Plaque Index by Schick and Ash grades on the extent of visible plaque at the gingival margin on selected teeth.⁷ The Navy Plaque Index scores plaque presence on three zones of the tooth (the occlusal, middle and gingival thirds), with the gingival zone divided into three subcategories based on the extent of the plaque present.⁸ The last index that has been used in many studies to quantify plaque is the Modified Plaque Index by Turesky and coworkers.⁹ This comprehensive index has five grades of plaque accumulation.

All of these indexes record the amount of plaque as well as the tooth surface on which the plaque is located, but their accuracy is limited and their complexity cumbersome. For use on a routine basis, these indexes are not practical and cannot be used easily in a private practice.

In clinical practice, some form of the O'Leary Plaque Control Record¹⁰ is commonly used when recording patient plaque scores. O'Leary's suggestion of recording only the presence or absence of plaque on four surfaces per tooth (mesial, distal, facial and lingual) is useful at identifying oral hygiene deficiencies and is more accurate than trying to grade the extent of plaque on each surface. However, an average dentition with 28 teeth requires that 112 surfaces be assessed for the presence of plaque. O'Leary reasoned that

“when an assistant records the findings of the examiner, the recordings can be completed in approximately five to six minutes.”¹⁰ In reality, the plaque index often is completed by the hygienist with no assistant available, thereby increasing the time for an accurate plaque index evaluation. During a typical one-hour maintenance appointment, this time frame is not practical and usually results in the recording of a subjective observation like “moderate plaque accumulation.”

The Plaque Assessment Scoring System, or PASS, presented in this study allows an examiner to objectively record plaque accumulation on selected teeth in a time-efficient manner. Also, using PASS, an examiner is able to assess subgingival plaque accumulation, which is not evaluated by other indexes. Because of its location and composition of high levels of gram-negative anaerobic pathogens, subgingival plaque is central to the progression of periodontitis.^{11,12} The O’Leary index assesses only visible supragingival plaque.

The purpose of this study was to compare the accuracy and time efficiency of PASS vs. the O’Leary index so that the clinician may have a time-efficient and objective assessment of their patients’ oral hygiene effectiveness.

MATERIALS AND METHODS

Using the PASS and the O’Leary Plaque Control Record methods, we examined 35 adults for the presence of plaque. Examiners first evaluated the participants using the PASS and then using the O’Leary index.

To establish a PASS score, an examiner selects five teeth for examination (four first molars and one maxillary incisor). If one of these teeth is missing, then an adjacent distal tooth or, if that tooth is missing as well, a mesial tooth is considered. If no maxillary incisors are present, a mandibular incisor can be substituted. Each tooth selected is divided into four areas: mesial, distal, buccal and lingual.

Using a periodontal probe, the examiner sweeps each quarter of the tooth approximately 1

millimeter into the sulcus to detect plaque. If plaque is visible on the probe, the surface is counted as positive for plaque accumulation. There are 20 possible plaque surfaces. The PASS score is the percentage of surfaces positive for plaque accumulation (Figure 1).

After the PASS examination, participants rinsed for 30 seconds with a disclosing solution. The O’Leary index consisted of recording the presence or absence of disclosed plaque on the mesial, distal, buccal and lingual surfaces of all teeth. The percentage of disclosed plaque was then calculated for each participant.

All of the participants had been diagnosed as having refractory periodontitis. Each had received periodontal surgery and antibiotic therapy, and was on a long-term frequent maintenance program.

The study was conducted in two phases.

In the first phase, all patients were examined once for each index and both indexes were performed by the same examiner. An assistant recorded the number of plaque-covered surfaces as they were called out by the examiner, which prevented the examiner from comparing the indexes as he or she recorded them. The scores were calculated after both indexes were complete.

In the second phase, examiners used both methods to record the presence of plaque in eight new participants. We conducted the second phase to determine the amount of time required to perform each of the plaque-assessment methods. Unlike the first phase, during which an assistant recorded the data, the second phase required

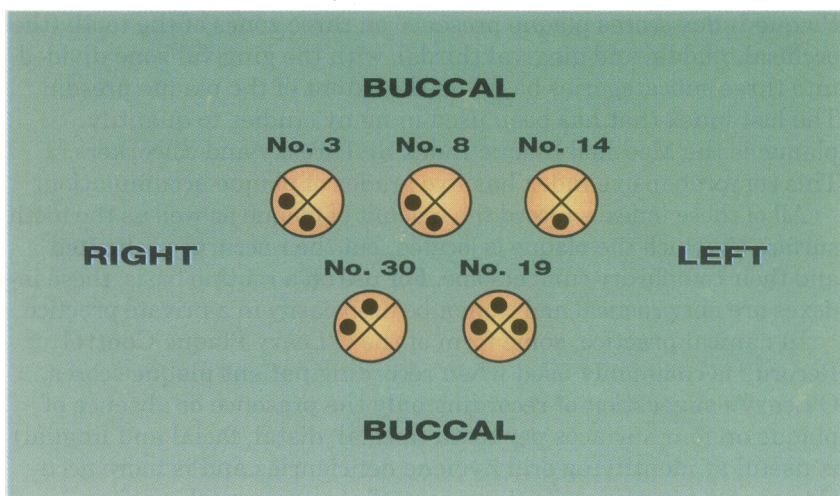


Figure 1. Example of the format used to record the presence of plaque using PASS. This example indicates the presence of plaque on 10 surfaces, representing a 50 percent PASS score.

TABLE

DATA COMPARISONS OF PASS AND O'LEARY INDEXES.

PLAQUE INDEX	MEAN	SD*	SEM†	MINIMUM	MAXIMUM	RANGE	TIME (MINUTES)
PASS (%)	33.29	12.83	2.17	15	60	45	1.47
O'Leary (%)	34.91‡	11.14	1.88	14	58	44	7.07

* Standard deviation.
† Standard error of the mean.
‡ A correlation of $r = 0.7$, which is significant at $P = .0001$, was found between the two indexes.

that the examiners record the data themselves to simulate a private practice setting. Using a stopwatch, an observer recorded the number of minutes required for each examination. The practitioners were unaware of the amount of time that elapsed.

We used the Pearson Correlation Coefficient to determine the agreement between the two plaque-assessment methods.

RESULTS

Overall, we found a strong positive correlation between the mean PASS and the mean O'Leary Plaque Control Record scores ($r = 0.7$, $P = .0001$), which indicates that the measurements recorded were consistent between the two methods. In considering correlations between the scores for individual participants, however, we found some isolated instances in which the correlation was poor (Figure 2).

The mean plaque index (\pm SD) recorded with the PASS was 33.29 percent (\pm 12.83) compared with a mean of 34.91 percent (\pm 11.14) recorded with the O'Leary index (Table).

We found that examiners took an average time of 7.07 minutes to record the O'Leary index and 1.47 minutes to record the PASS index.

DISCUSSION

The results from this study demonstrate an overall agreement between the PASS and O'Leary Plaque Control Record. However, as seen in Figure 2, there were some instances in which the correlation was poor. These results resemble those reported by Greene and Vermillion in comparing the Simplified Oral Hygiene Index with the original Oral Hygiene Index;

the means were similar but the standard deviations were high.⁶ Individual variations always will exist unless the same method and index is used at every examination.

We expected to detect some disagreement between the measures achieved with the techniques used in this study because of the differences in methodology. Examiners using the PASS index measured plaque accumulation at the supragingival and subgin-

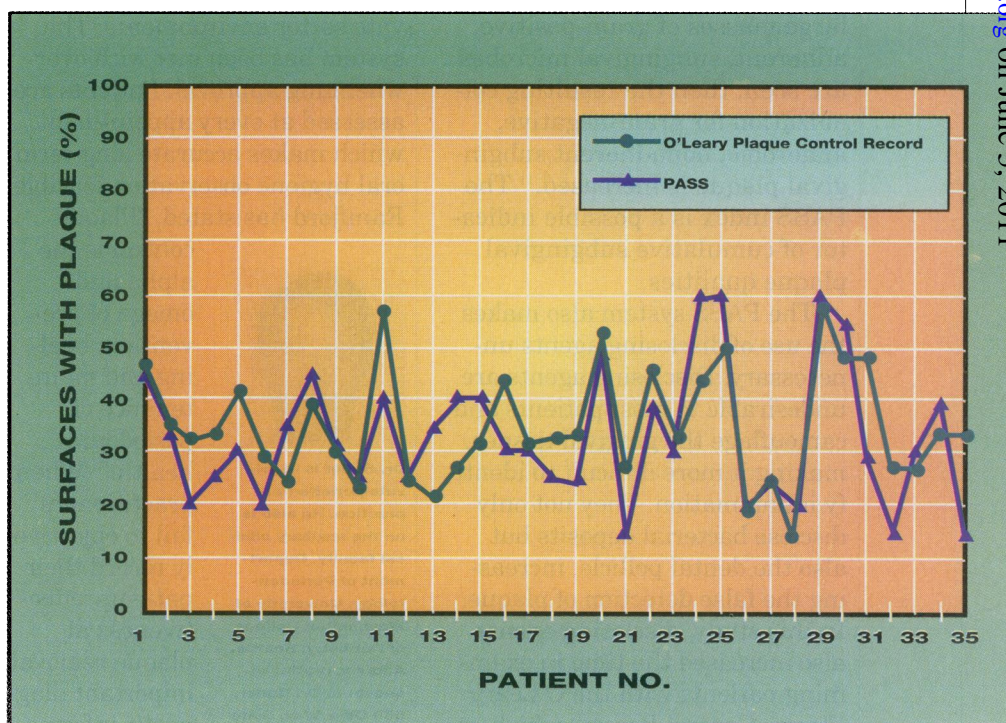


Figure 2. A graph of the PASS and O'Leary index scores for each participant shows that, although there was a strong correlation between the mean data, there were instances in which the plaque indexes varied between the methods.

gingival margin by sweeping a probe along the surface of the tooth and 1 mm below the gingival margin. This is unlike the O'Leary index, in which only disclosed supragingival plaque is counted. The difference in techniques would account for significant error and is possibly why the correlation was not ideal.

Differences also were amplified because all of the participants had low to moderate plaque scores for both indexes. Also, the participants were enrolled in a rigid periodontal maintenance program. Perhaps selecting patients with a broader range of scores would have elicited different results.

Currently, no index tries to quantify the extent of subgingival plaque present. The PASS index is not proposed as being an exact method of quantifying subgingival plaque, but it does provide a gross estimate of adherent subgingival plaque. If large masses of gram-positive, adherent, subgingival microbes are seen, then the resulting colonization for gram-negative, anaerobic, nonadherent subgingival plaque is increased.¹¹ The PASS index is a possible indicator of cumulative subgingival plaque qualities.

The PASS system also makes the use of disclosing agents unnecessary. Disclosing agents are undesirable to most patients and camouflage the gingival tissues, making it more difficult to identify inflammation. They not only disclose bacterial deposits but also the dental pellicle, increasing the false detection of plaque. In this study, disclosing agents also increased the time in examining patients with the O'Leary Plaque Control Record, which explains part of the difference

noted in the mean times of 1.47 minutes to complete the PASS examination and 7.07 minutes for the O'Leary index.

Selecting the four first molars and one maxillary incisor allows the examiner to identify problem areas in all four quadrants without identifying the plaque-covered surfaces on all teeth. In a similar approach, Ramfjord selected "the Ramfjord teeth" that would represent the periodontal health of the entire dentition.¹³

Like the Simplified Oral Hygiene Index or Ramfjord's Periodontal Disease Index, PASS cannot be totally accurate, but it does appear to be within an acceptable limit and can be completed quickly. Time is a limiting factor in every practice, and techniques that are accurate and performed easily likely will be used.

The PASS system has been used in both academic and private sector environments. The system has been met with overwhelming approval. Patients are assessed at every appointment, which makes accurate long-term oral hygiene observation feasible. Ramfjord has stated, "Plaque

control is the alpha and omega of prevention, healing and maintenance of periodontal health."³ When practitioners fail to objectively record their patients' effectiveness at plaque removal, important diagnostic information is lost.



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CONCLUSION

Lengthy and time-consuming plaque indexes during a one-hour maintenance appointment are unrealistic. This duty is usually delegated to the dental hygienist, who often must record the scores without an assistant. The PASS method is ideal for the solo examiner.

We conclude that PASS demonstrates statistical reliability when compared with the O'Leary Plaque Control Record and is a time-efficient method to assess plaque control. ■

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