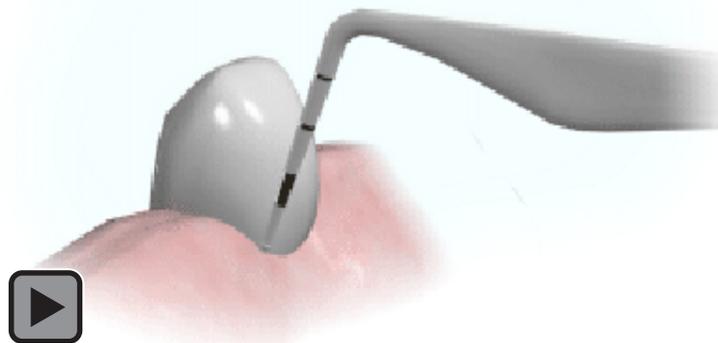


The Application of Periodontal Screening and Recording™ (PSR) on a Military Population

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Abstract

Periodontal Screening and Recording™ (PSR) is a diagnostic screening tool for the early detection of periodontal disease. The purposes of this study are to utilize PSR to estimate the periodontal health status of a representative military population and to compare the results with other studies of varying populations. When used to evaluate the periodontal health of a randomly-selected military population, PSR demonstrated the following: (1) males and females had a similar prevalence of being designated PSR⁺ (having PSR Code 3 score in two or more sextants or a PSR Code 4 score in at least one sextant), (2) Blacks and Hispanics had a similar prevalence of PSR⁺, and (3) both groups were twice as likely to be PSR+ as were Caucasians. Although income did not appear to be a significant predictor of PSR⁺, PSR⁺ did appear to be inversely proportional to education levels. When comparing PSR scores by sextant, the following was noted: (1) the maxillary central sextant was the most disease-free, (2) the mandibular central sextant most often presented with calculus, (3) mucogingival defects were observed more frequently in maxillary posterior sextants, and (4) the maxillary right sextant demonstrated the most destruction from periodontal disease.

Keywords: Periodontal Screening and Recording, PSR, periodontal disease screening systems, prevalence of periodontal disease

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Introduction

Periodontal disease remains a significant health problem and is a major cause of tooth loss in adults both in the United States and throughout the world.¹⁻¹⁰ Despite the continuing scientific advances geared toward the treatment of periodontal disease, early diagnosis is essential to limit the extent and increase the potential for success of any definitive therapy provided. In addition, failure to diagnose and treat periodontal disease or provide timely referral of patients for treatment may lead to litigation.¹¹⁻¹³



Numerous screening systems have been developed to detect periodontal disease. Some classic examples are: Periodontal Index (Russell)¹⁴, Periodontal Disease Index (PDI, Ramfjord)¹⁵, Periodontal Treatment Needs System (PTNS, Johansen, et al.)¹⁶, Periodontal Profile Score (PPS, Rand Corporation)¹⁷, Community Periodontal Index of Treatment Needs (CPITN, Ainamo, et al.)¹⁸, and the Extent and Severity Index (ESI, Carlos, et al.)¹⁹ among others. Although each of these systems is effective, none have been universally accepted or are routinely used by most general practitioners. Many dentists consider using the above periodontal screening methods to be confusing, time consuming, and, most importantly, not cost-effective.

On October 6, 1993, the American Dental Association (ADA), with the endorsement of the American Academy of Periodontology (AAP) and sponsorship by the Procter & Gamble Company (P&G), officially introduced Periodontal Screening and Recording™ (PSR) as the recommended system for the early detection of periodontal disease in patients in the United States. PSR is a modification of the CPITN Index endorsed by

the World Health Organization (WHO). First introduced in the U.S. in 1992, PSR is a quick, reliable, and reproducible method for identifying patients that may require a more complete evaluation of their periodontal health status.

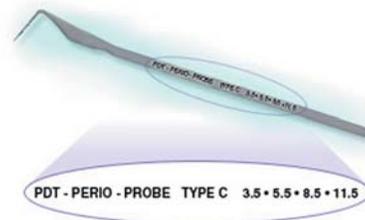
Lo Frisco surveyed American dentists' attitudes towards PSR and reported 77% of general dentists and 88% of periodontists rated PSR as good to excellent overall.²⁰ Additional perceived benefits included early disease detection (sensitivity), speed, simplicity, cost-effectiveness, efficient record keeping, risk management, and patient education. Khocht, et al. reported PSR scores had a greater correlation with probing depths and clinical attachment levels than either bitewing or periapical radiographs.²¹ They concluded their results support the use of PSR as a valuable screening tool for periodontal diseases.

The purposes of this study are: (1) to utilize PSR to estimate the periodontal health needs of a representative military population and (2) to compare the results with other studies of varying populations.

Methods and Materials

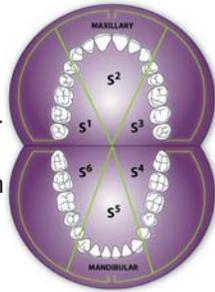
Five hundred active duty military personnel at Fort Bragg, North Carolina were randomly selected for evaluation of their periodontal health status using PSR in conjunction with their annual dental examination. A single calibrated examiner performed all PSR screenings over a two-month period. An assistant recorded the patient's name, age, rank, gender, racial background, and PSR scores by sextant.²²

The plastic PSR Periodontal Examination Probe (Figure 1) was used throughout this study.^{18,22} The probe has a 0.5 mm diameter ball tip and a color-coded band extending 3.5 mm to 5.5 mm from the tip. The ball tip enhances detection of subgingival calculus or overhanging margins and limits false readings from over-measurement of probing depths. The colored band facilitates rapid interpretation of probe depths.



The examination consists of gently inserting the PSR probe into the gingival sulcus of each tooth until light resistance is met and then “walking” the probe around the tooth’s circumference. The greatest probe depth in each sextant of the mouth is determined and recorded.^{18,22} Probing forces should not cause pain and should be approximately 20-25 gm, or roughly equal to the force of blanching a fingernail. This approximates the resistance at the coronal border of the periodontal attachment apparatus.¹⁸

Intraoral sextants are designated S1-S6²², beginning in the maxillary right sextant (S1), proceeding in a clockwise manner, and finishing in the mandibular right sextant (S6). Each sextant is assigned a code based on the highest probing value obtained on any tooth in that sextant.



PSR codes are based on the following system²²:

- **Code 0** - Colored area of probe remains completely visible in the deepest crevice in the sextant. No calculus or defective margins are detected. Gingival tissues are healthy with no bleeding after gentle probing.
- **Code 1** - Colored area of probe remains completely visible in the deepest probing depth in the sextant. No calculus or margins are detected. There is bleeding after gentle probing.
- **Code 2** - Colored area of probe remains completely visible in the deepest probing depth in the sextant. Supra- or subgingival calculus and/or defective margins are detected.

- **Code 3** - Colored area of probe remains partly visible in the deepest probing depth in the sextant.
- **Code 4** - Colored area of probe completely disappears, indicating probing depth of greater than 5.5 mm.
- **Code *** - Denotes clinical abnormalities including but not limited to furcation invasion, mobility, mucogingival problems, or recession extending to the colored area of the probe (3.5 mm or greater).
- **Code X** - Denotes edentulous sextant.

Following the examination, each patient is told his/her PSR score (along with an explanation of its significance) and given an appropriate follow-up appointment in accordance with the PSR findings.

Results

The sample population consists of 413 males and 87 females. A number of parameters were evaluated (e.g., age, race, gender, rank, education, and income levels) to determine their correlation with PSR scores. Ages range from 18 to 54 years, with a mean age range of 25-34 years (Table 1).

Table 2 displays the estimated periodontal health needs of the study group. Of particular interest is the finding only two of the 500 patients examined are disease-free (PSR code 0) in all six sextants and none are edentulous (PSR code X in all sextants). Our findings indicate 82% of patients examined presented with gingivitis (PSR codes of 1 and 2, with not more than one PSR code 3). Roughly 18% are estimated to have periodontitis (PSR code 3 in two or more sextants or at least one PSR code 4). The designation PSR+ is used

Table 1. Age and gender distribution

Age	Total	% Total	Male	% Male	Female	% Female
18-24	168	33.6%	130	77.4%	38	22.6%
25-34	238	47.6%	202	84.9%	36	15.1%
35-44	79	15.8%	68	86.1%	11	13.9%
45-54	15	3.0%	13	86.7%	2	13.3%
Total	500	100.0%	413	82.6%	87	17.4%

Table 2. Periodontal health status

Status	Total	% Total
Disease-free	2	0.4%
Gingivitis	410	82.0%
Periodontitis (PSR+)	88	17.6%
Total	500	100.0%

to represent the 88 patients listed in Table 2 as likely having periodontitis. As per established guidelines of the system, PSR⁺ patients should be referred for a comprehensive periodontal examination to determine a definitive diagnosis and treatment plan.

Of the 88 patients listed as PSR⁺, 73 are male and 15 are female. Although males comprise 82.6% and females 17.4% of the population evaluated, interestingly, males and females present with PSR⁺ at an identical rate of 17% (Table 3).

The percentages of PSR scores by sextant appear in Table 4. The maxillary central sextant (MxC) is free of disease in 32% of patients examined. In contrast, the mandibular central sextant (MnC) is disease-free in only 1.8% of patients. Although the MnC exhibits bleeding upon probing (PSR code 1) in only 8.2% of patients, 85.6% have calculus present (PSR code 2). The maxillary right sextant (MxR) has PSR codes 3 and 4 most often and would, therefore, appear to be the sextant most susceptible to periodontal disease. Mucogingival defects are most frequently present in the maxillary posterior sextants (MxR and MxL).

The findings in Table 5 demonstrate a progressive increase in the incidence of periodontal disease with age. While less than 8% of patients in the 18-24 age group are designated PSR⁺, the percentage of PSR⁺ doubles (males 14.9%, females 19.4%) in the 25-34 age group. After age 35, the likelihood of PSR⁺ increases dramatically in both sexes; in the 35-44 age group, 41.2% of males and 36.4% of females are PSR⁺, but then plateaus, as the 45-54 age group shows PSR⁺ rates of 38.5% for males and 50% for females.

Table 6 displays the racial prevalence of periodontal disease. Blacks (28.6%) and Hispanics (26.5%) have equal PSR⁺ prevalence; this is twice the rate of Caucasians (13.5%). Asian and "other" races also demonstrate very high prevalence levels, especially when compared to Caucasians.

Table 7 presents the PSR⁺ distribution by military rank (e.g., officers, warrant officers, and enlisted personnel). Enlisted personnel are divided into 2 subgroups: junior (ranks E-1 through E-4) and senior (ranks E-5 through E-9). Our findings suggest education level may be a factor of periodontal health. Officers generally have more formal education than warrant officers, with enlisted personnel having the least. Officers seem to have

Table 3. Total PSR+ distribution by gender

Gender	Total	% Total	PSR+	% PSR+
Male	413	82.6%	73	17.7%
Female	87	17.4%	15	17.2%
Total	500	100.0%	88	17.6%

Table 4. PSR scoring by sextant

PSR Score	MxR	MxC	MxL	MnR	MnC	MnL
0	3.8%	32.0%	7.6%	8.8%	1.8%	9.8%
1	59.4%	55.6%	50.4%	60.4%	8.2%	64.6%
2	17.8%	10.6%	24.6%	17.0%	85.6%	11.6%
3	14.4%	5.2%	14.0%	10.0%	3.0%	11.2%
4	2.8%	0.4%	1.4%	2.6%	0.6%	1.8%
*	1.2%	0.6%	1.2%	0.8%	0.8%	0.6%
X	0.6%	0.4%	0.8%	0.4%	0.0%	0.4%

Table 5. PSR+ distribution by age and gender

Age	PSR+ Male	% PSR+ Male	PSR+ Female	% PSR+ Female
18-24	10	7.7%	3	7.9%
25-34	30	14.9%	7	19.4%
35-44	28	41.2%	4	36.4%
45-54	5	38.5%	1	50.0%
Total	73	17.7%	15	17.2%

Table 6. PSR+ distribution by race

Race	Total	PSR+	% PSR+
Caucasian	364	49	13.5%
Black	91	26	28.6%
Hispanic	34	9	26.5%
Asian	5	1	20.0%
Other	6	3	50.0%
Total	500	88	17.6%

Table 7. PSR+ distribution by rank

Rank	PSR+ Male	% PSR+ Male	PSR+ Female	% PSR+ Female
Jr. Enlisted	34	12.2%	10	16.9%
Sr. Enlisted	25	51.0%	2	33.3%
Warrant	5	33.3%	0	0.0%
Officer	9	12.7%	3	13.6%
Total	73	17.7%	15	17.2%

the lowest percentage of PSR+ as compared to warrant officers or the enlisted personnel. Male warrant officers and female senior enlisted personnel have equal prevalence of PSR+ (33%), while over 50% of the male senior enlisted personnel are in the PSR+ status.

The potential effect of income on PSR status (Table 8) seems to suggest income (based on rank and salary) is not a good predictor of periodontal health. The low-income group (annual salary less than \$25,000) consists of E-1 through E-4 personnel. The middle-income group (annual salary ranging from \$25,000 to \$50,000) contains the ranks E-5 through E-8, warrant officers (CW1- CW3), and junior officers (O-1 and O-2).

Table 8. PSR+ distribution by income

Income	Sex	Total	PSR+	% PSR+
Low < \$25k/Yr	Male	145	17	11.7%
	Female	41	7	17.1%
	Total	186	24	12.9%
Middle \$25-50k/Yr	Male	215	45	20.9%
	Female	38	7	18.4%
	Total	253	52	20.6%
High > \$50k/Yr	Male	53	11	20.8%
	Female	8	1	12.5%
	Total	61	12	19.7%

The high-income group (annual salary exceeding \$50,000) includes senior enlisted personnel (E-9), senior warrant officers (CW4), and senior officers (O-3 through O-6).

Discussion

This study provides a “snapshot” of the periodontal status of a randomly-selected military population as evaluated by the PSR system. Other demographic data (e.g., age, gender, race, rank, education, and income) were evaluated with respect to individual periodontal status. A military population from a large installation provides an excellent potential study group because of the wide diversity of ethnic and cultural backgrounds, education, income, and occupations. Many military personnel live in the civilian community with lifestyles reflecting a modern post-industrial society. A distinct disadvantage with utilizing a military population is its relative youth, as only 3 patients in this study are 50 years or older.

None of the soldiers were previously screened for periodontal disease using the PSR system. Past dental treatment levels, from either civilian dentists or within the Army Dental Care System, range from new soldiers presenting without prior dental care to senior military personnel with over 20 years of regular professional dental care.

One examiner performed all of the PSR screening examinations in this study. The single-examiner concept maintains consistency and eliminates inter-examiner bias. Our intent was to have a general dentist use the PSR system following

routine introductory training from the instructional brochure and videotape included in the PSR training program kit.²² This is the manner in which most general dentists would learn to incorporate PSR into their practices.

We compared our results using the PSR system to estimate periodontal health in our sample population with other studies using various diagnostic methods on different populations. While we report an overall prevalence of gingivitis at 82% and periodontitis at 17.6% in U.S. Army soldiers, Brown, et al.¹ reported over 50% of U.S. adults have gingivitis, and roughly 30% of the adults have periodontitis, as measured by probing depths exceeding 4 mm. Hirotomi, et al.²³ found 75.1% of a Japanese adult population exhibited attachment loss of 3 mm or greater, while 47.9% had evidence of severe periodontitis with attachment loss of 7 mm or more.

Horning, et al.²⁴ reported prevalence rates of 37% gingivitis only, 33% early periodontitis, and 29% moderate to severe periodontitis using full-mouth circumferential periodontal probing on Navy personnel. In a prevalence study of Army personnel, Querna, et al.²⁵ used a Glickman 26G probe (similar to the conventional PSR probe) along with slight variations in PSR protocol according to the Periodontal Screening Exam (PSE) index. They found 12.1% of subjects were disease-free, while 40.3% demonstrated gingivitis, 35.7% had early periodontitis, and 11.9% displayed moderate to severe periodontitis.

Katz, et al.²⁶ performed a study with some similar parameters to our study. They examined Israeli military personnel using CPTIN criteria (essentially PSR minus the * code). They found 1.2% of personnel to be disease-free (versus 0.4% in our study), with males exhibiting periodontitis at 3 times the rate of females (18.7% of males and 6.2% of females). This contrasts with our findings, which suggests the prevalence of periodontitis is equal among males and females (17%). Our conclusions agree with this study in the notion that persons with higher education tend to have less gingivitis and/or periodontitis than less educated individuals.

Dye and Vargas²⁷ found 3% of U.S. adults examined required complex periodontal treatment, 90%

needed scaling and root planing, and 5% required no treatment. They concluded being older, male, non Hispanic black, having lower education, smoking, and without any dental visits in the last year increased the likelihood of needing more complex periodontal treatment. Our findings agree with the above results with the exception of higher prevalence of periodontitis in males.

Our results using PSR differ somewhat from Salkin, et al.²⁸ They used PSR to screen patients in a multi-site dental practice in Philadelphia from July 1991 through February 1992. They found 4.4% of the patients screened were free of disease, 59.2% had gingivitis, and 40.9% had periodontitis.

Although Abdellatif and Burt²⁹ conclude the effect of age on the progression of periodontitis is negligible when adequate oral hygiene is maintained, our results in Table 5 seem to agree with other studies that suggest the prevalence and severity of periodontal disease increases with age (1-4, 24-28).

Military officers have the lowest percentage PSR⁺, which may correlate education levels with PSR status. However, access to care may be another variable in this parameter. Male warrant officers display a much greater percentage of PSR⁺ than officers or junior enlists. This may be partially explained by the fact most of the warrant officers in the study (67%) are over the age of 35, whereas most of the enlisted personnel (69%) are under age 35. The low percentage of junior enlisted personnel in PSR⁺ status is misleading for the same reasons; most junior enlisted may be too young to exhibit advanced periodontal disease.

Recent studies (30-34) conclude income and socioeconomic status directly correlate with prevalence of periodontal disease. Our findings seem to indicate income is less of a factor when estimating disease in our sample population. This is probably due to the fact dental services are offered to soldiers at no cost, regardless of rank. Therefore, income is not a predictor of periodontal health in a military setting.

Patients respond favorably to the PSR screening system and appreciate receiving a quantifiable score (similar to a blood pressure or cholesterol

value) as an assessment of their periodontal health status. This observation agrees with the Roper Report on Oral Health³⁵ commissioned by the ADA, AAP, and P&G. Charles and Charles³⁶ note describing periodontal disease as “early,” “moderate,” or “severe” is often vaguely understood by patients. In contrast, patients seem to better relate to the numerical values used in the PSR system, especially when the patient receives the PSR color brochure²² following the examination. The brochure provides photos and detailed explanations of each PSR score to further enhance the patient’s understanding of their periodontal condition.

The results of a study by Benigeri, et al.³⁷ seem to further validate the sensitivity of the PSR system. They compared different approaches for measuring and recording probe depths using the CIPTN index in Canadian patients aged 35-44. They determined any method involving the partial recording of probe depths (using 10 index teeth versus full mouth probing, choosing only 2 quadrants at random for assessment, or probing on just 2 sites on a tooth versus probing all around the tooth) resulted in an underestimation of periodontal disease. In addition, using the percentage of subjects with periodontal pockets overestimates the prevalence of deep pockets compared with using sextants.

Although recommended for use (but not mandatory) in private practice, PSR is now a standard component of the oral examination in the Army Dental Care System. It must be emphasized, however, that PSR is a periodontal health screening index and is not a diagnostic tool for periodontal disease when used alone. A comprehensive periodontal examination is indicated for patients exhibiting PSR⁺ scores before arriving at a definitive periodontal diagnosis and treatment plan.

Summary

When used to evaluate the periodontal health of a randomly-selected military population, the PSR system demonstrated the following:

1. Males and females had a similar prevalence of being designated PSR⁺ (having PSR Code 3 score in two or more sextants or a PSR Code 4 score in at least one sextant)
2. Blacks and Hispanics had a similar prevalence of PSR⁺
3. Both groups were twice as likely to be PSR⁺ as were Caucasians

Although income did not appear to be a significant predictor of PSR⁺, PSR⁺ did appear to be inversely proportional to education levels. When comparing PSR scores by sextant, the following was noted: (1) the maxillary central sextant was the most disease-free, (2) the mandibular central sextant most often presented with calculus, (3) mucogingival defects were observed more frequently in maxillary posterior sextants, and (4) the maxillary right sextant demonstrated the most destruction from periodontal disease.

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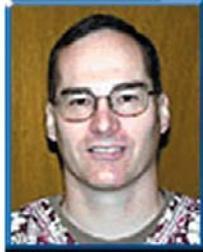
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