

Periodontal Services Rendered by General Practitioners

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Background: There are few reports in the dental literature regarding the types of periodontal services offered by general practitioners (GPs). The purpose of this study was to determine the specific nature of periodontal services rendered by GPs and to investigate whether certain variables affect GPs' practice patterns.

Methods: A 13-item survey was mailed to a random sample of 600 dentists practicing in the state of Virginia. GPs were asked to identify the periodontal services rendered in their office within a 3-month period. Descriptive statistics, simple correlation, and stepwise multiple regression analysis were used to identify significant relationships between variables and periodontal services.

Results: Ninety percent of GPs reported treating at least one patient with scaling and root planing, and 16% of GPs reported rendering this service to >36 patients. Eighty-six percent of GPs reported providing periodontal maintenance in their practices. Approximately 50% of dentists reported up to 24 patients having received periodontal maintenance. Fifty-eight percent of GPs reported that ≥90% of scaling and root planing was done by the hygienists. Fifty-five percent of GPs treated at least one patient with site-specific therapy using chemotherapeutic agents. Twenty-eight percent of GPs treated one to five patients with low-dose antibiotic. Seventy percent of GPs treated at least one patient with occlusal therapies, and 50% reported treating one to five patients with occlusal therapies. The most common surgical services performed included crown lengthening and pocket reduction surgery, which were done by 38% and 21% of GPs, respectively. A few GPs (N = 26) performed the majority of periodontal surgical services. Variables found to influence specific services rendered by GPs included year of dental school graduation, recent hours of continuing education related to periodontics, combined number of dental hygienist days per week, percentage of periodontal patients in practice, and referral for non-surgical periodontal therapy.

Conclusions: A variety of periodontal services were offered by GPs. The most common services were non-surgical in nature. Certain variables affected specific periodontal services rendered in general dental offices. *J Periodontol* 2007;78:823-832.

KEY WORDS

Data collection; dentistry; general practice, dental; periodontics; referrals and consultation; survey.

There are few reports in the literature on periodontal services provided by general practitioners (GPs). Some speculated that more periodontal services are being rendered in the general dental office, leading to a decrease in timely referrals to periodontists.^{1,2} Advances in, and dissemination of, periodontal knowledge,¹ availability of controlled-release local drug delivery systems,^{1,3,4} current training of dental care providers,^{2,5,6} changes in practice management and practice philosophies,^{1,2,7} changes in demands for services,⁸ and patient-based issues¹ could lead to GPs performing more periodontal services.

Betof et al.⁹ reported that dentists younger than 30 years of age with presumably more current knowledge of periodontics were more likely to treat periodontal disease in their practices. Dentists 31 to 45 years of age were more likely to refer patients to a periodontist for treatment. However, dentists who were older than 65 years of age referred fewer patients, and 60% of dentists in this age group reported providing periodontal services in their practices. Furthermore, Zemanovich et al.¹⁰ found no difference in periodontal referrals based on dentists' age or years of practice.

Brown et al.¹¹ reported that practices employing dental hygienists provided significantly more periodontal services than practices not employing dental hygienists. The removal of subgingival calculus consisted of nearly 60% of all procedures performed by the hygienists. The delivery of chemotherapeutic agents may be another area in which dental hygienists will play a key role.⁴

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The purpose of this study was to determine the specific nature of periodontal services rendered by GPs in the State of Virginia. It was hypothesized that variables, such as year of dental school graduation, formal advanced training, recent hours of continuing education related to periodontics, combined number of dental hygienists days per week, percentage of periodontal patients in practice, and most common reasons for referral to a periodontist affect the types of periodontal services offered by GPs. This study also investigated the types of services referred to periodontists and whether these variables affected the referral process. It may be helpful for periodontists to understand GPs' periodontal practices and referral patterns. Such information may help the periodontist establish and maintain a sound referral base, which is vital to a successful specialty practice.

MATERIALS AND METHODS

Survey Design

This investigation was approved by Virginia Commonwealth University's Institutional Review Board. This study was conducted from March 2005 to October 2006. A 13-item survey addressing the following was developed: 1) demographics of the dentist, including whether the dentist practiced as a GP; 2) periodontal services provided in the practice; 3) services delegated to a hygienist; 4) percentage of patients in the practice with periodontal disease, excluding gingivitis; and 5) periodontal services referred to periodontists. A detailed description of all periodontal services was included on the survey. Each description included all of the appropriate procedures and American Dental Association codes,¹² where applicable. For example, the description for occlusal therapies was "occlusal therapies for the treatment of the periodontal patient, including splinting [D4320], occlusal adjustment [D9951, D9952], and occlusal guard [9940]." The description for soft tissue grafting was "pedicle [D4270], free gingival graft [D4271], connective tissue graft [D4279], allograft [D4275], connective tissue plus pedicle [D4276]." Periodontal services were paraphrased here to make the presentation and discussion of these services more concise. A six-member focus group of dentists (four GPs and two periodontists) independently reviewed the survey for clarity and thoroughness prior to its distribution.

Data Collection

An introductory cover letter, the survey, and a preaddressed postage-paid return envelope were mailed to a simple random sample of 600 dentists with dental licensure in the state of Virginia. This sample was obtained using a database from the Virginia Board of Dentistry. Surveys were identified with a code to preclude a second mailing of the same survey once the

dentist responded. Three mailing cycles were completed with 3 weeks separating each cycle.

Statistical Methods

Periodontal services were described using frequency counts and percentages or means \pm SD. Comparisons were made using χ^2 analysis or analysis of variance, as appropriate. Cluster analysis (Ward's method) was used to identify the similarities in practice patterns. Simple correlation and stepwise multiple regression were used to identify the significant relationships between variables and periodontal services. All tests were performed using statistical software,[§] and significance was declared at $\alpha = 0.05$.

RESULTS

Of the 600 surveys mailed, 379 (63%) were completed and returned after three mailing cycles. After excluding dentists who indicated that they were retired, no longer practicing dentistry, or who did not practice as a GP, there were 241 eligible respondents (40% of the original mailing and 64% of the total respondents) included in the subsequent analyses. In the tables, the number of respondents typically is slightly <241 because of incomplete data items on the returned surveys.

Responses indicated that GPs graduated from dental school between 1950 and 2002 (Table 1) with 10% of GPs graduating before 1970. Thirty-one percent of GPs graduated in the 1970s, and 33% graduated in the 1980s. The average year of graduation was 1983 (SD = 11). Twenty-six percent of GPs graduated after 1990. When asked about postgraduate dental training, 61% of GPs responded that they had none beyond dental school, and 19% reported completing an "Advanced Education in General Dentistry (AEGD)" program. This latter response may have included other postgraduate training. Nine percent of GPs indicated that they had completed a "General Practice Residency" (GPR) and 11% of GPs indicated some "other" formal advanced dental training.

All but eight of the GPs (3%) had earned continuing education (CE) credit in the last 5 years relating to periodontics (Table 2). Ninety-seven percent of GPs reported CE, with 42% completing ≥ 17 hours. More than 90% of GPs practiced between 3 and 5 days a week. Two percent of GPs practiced >5 days a week, and ~3% practiced <2 days per week (Table 2). Dentists were asked to quantify the combined number of days per week that all dental hygienists in their individual practices provided patient care. The most common response was 3 to 5 days, offered by 38% of GPs. Twenty-two percent of GPs had totals >7 days (Table 2). Dentists also were asked about the percentage of their patients with periodontal disease (Table 2).

§ JMP, version 6.0.2, SAS Institute, Cary, NC.

Using the mid-point of the indicated range as an estimate, the average GP indicated that 28% of his/her patients had periodontal disease, excluding gingivitis (SD = 16%).

Dentists indicated the number of their patients who received various treatments within the last 3 months. The average responses for the 11 treatments under investigation are shown in Table 3. For each treatment option, there were GPs who treated zero patients and

others who treated the maximum range of patients. Although there was tremendous variety in practice patterns, similarities were evident. Responses to the first three non-surgical service items (scaling and root planing one to three teeth, scaling and root planing four or more teeth, and periodontal maintenance), referred to as group A services, were correlated (average $r = \sim 0.60$). If a GP indicated that he/she performed high numbers of one procedure, then he/she tended to perform high numbers of the others. The fourth through sixth items (site-specific therapy using chemotherapeutic agents, low-dose antibiotic, and occlusal therapies) were related to each other to a lesser degree (average $r = \sim 0.47$). These items are referred to as group B services. The last five treatment items involving surgical therapy, referred to as group C services, were highly correlated (average $r = \sim 0.26$).

Regarding group A services, 91% of GPs surveyed indicated that at least one patient had scaling and root planing performed in their practice within the last 3 months, and 16% of GPs reported that >36 patients had this procedure done within the same time period (Table 3). Ninety-one percent of GPs performed localized (one to three teeth) scaling and root planing, with 24% treating ≥ 25 patients. Ninety-five percent of GPs performed generalized (four or more teeth) scaling and root planing, with 30% treating ≥ 25 patients. Eighty-six percent of GPs reported providing periodontal maintenance in their practices; 61% reported treating ≥ 13 patients within the last 3 months. The combined number of dental hygienist days per week and percentage of patients in practice with periodontal disease correlated positively with localized (one to three teeth) and generalized (four or more teeth) scaling and root planing and periodontal maintenance (Table 4). Referral for non-surgical

Table 1.
Year of Dental School Graduation and Type of Advanced Dental Training

	N	%
Year of dental school graduation		
1950s	4	2
1960s	19	8
1970s	72	31
1980s	76	33
1990s	42	18
2000s	18	8
Total	231	100
Formal advanced dental training		
AEGD	33	15
AEGD, other	5	2
AEGD, GPR	2	1
AEGD, GPR	2	1
GPR	16	7
GPR, other	4	2
Other	25	11
None	136	61
Total	223	100

Table 2.
Practice Characteristics

Characteristic	% (N)					Total
	0 Hours	1 to 8 Hours	9 to 16 Hours	17 to 24 Hours	>24 Hours	
Hours of CE credit relating to periodontics within the last 5 years	0 Hours 3 (8)	1 to 8 Hours 27 (64)	9 to 16 Hours 27 (64)	17 to 24 Hours 23 (55)	>24 Hours 19 (46)	237
Days per week dentists practice	0 to 2 days 3 (6)	>2 to 3 days 4 (10)	>3 to 4 days 44 (105)	>4 to 5 days 48 (115)	>5 days 2 (4)	240
Combined number of days per week DH provides patient care	0 to 1 days 17 (38)	>1 to 3 days 9 (19)	>3 to 5 days 38 (84)	>5 to 7 days 15 (33)	>7 days 22 (48)	222
Percentage of patients with periodontal disease (excluding gingivitis)	<1 1 (2)	1 to 10 9 (20)	11 to 20 27 (62)	21 to 30 29 (67)	>30 35 (82)	233

DH = dental hygienist.

Table 3.
Patients Who Received Periodontal Services in a 3-Month Period

Periodontal Service	% (N)					Total
	0	1 to 12	13 to 24	25 to 36	>36	
Localized scaling and root planing (1 to 3 teeth)	9 (21)	47 (109)	20 (47)	8 (19)	16 (37)	233
Generalized scaling and root planing (4 + teeth)	5 (12)	39 (93)	26 (62)	14 (33)	16 (39)	239
Periodontal maintenance	14 (33)	25 (59)	27 (64)	16 (37)	18 (43)	236
	0	1 to 5	6 to 10	11 to 15	>15	
Site-specific therapy using chemotherapeutic agent	46 (111)	26 (62)	16 (38)	6 (15)	5 (13)	239
Low-dose antibiotic	57 (137)	28 (66)	8 (19)	4 (10)	3 (7)	239
Occlusal therapy for the treatment of periodontal disease	28 (67)	50 (121)	11 (27)	8 (19)	3 (6)	240
Surgical crown lengthening	52 (125)	38 (91)	6 (14)	3 (6)	1 (3)	239
Soft tissue grafting	85 (204)	13 (31)	1 (2)	1 (2)	1 (2)	241
Surgical periodontal therapy for pocket reduction	76 (184)	21 (50)	2 (4)	1 (2)	0 (1)	241
Bone and/or guided tissue regeneration	88 (211)	11 (26)	1 (2)	0 (0)	0 (1)	240
Implant placement	84 (203)	11 (26)	2 (4)	1 (3)	2 (5)	241

periodontal therapy correlated negatively with periodontal maintenance and generalized scaling and root planing, but not with localized scaling and root planing. The number of CE credits earned relating to periodontics correlated positively with periodontal maintenance. The reason for referral to a periodontist correlated negatively with generalized scaling and root planing and periodontal maintenance.

Services in group B include site-specific therapy using chemotherapeutic agents, low-dose antibiotic, and occlusal therapies (Table 3). Fifty-three percent of GPs surveyed treated at least one patient with site-specific therapy in the last 3 months. Sixty-two GPs (26%) treated one to five patients with site-specific therapy within the same period. Approximately 43% of GPs treated at least one patient with low-dose antibiotic. Sixty-six GPs (28%) treated one to five patients with low-dose antibiotic. Seventy-two percent of GPs treated at least one patient with occlusal therapies, and 50% reported treating one to five patients with occlusal therapies. The combined number of dental hygienist days per week correlated positively with site-specific therapy and occlusal therapies (Table 4). The percentage of patients in the practice with periodontal disease correlated positively with low-dose antibiotic and occlusal therapies. Referral for non-surgical periodontal therapy correlated negatively with site-specific therapy. The reason for referral to a periodontist correlated negatively with site-specific therapy using chemotherapeutic agent.

The majority of GPs surveyed did not perform periodontal surgical procedures (group C services; Table 3). The most common surgical services performed included crown lengthening and pocket reduction surgery, done by 48% and 24%, respectively. Year of dental school graduation correlated positively with pocket reduction surgery, bone and/or guided tissue regeneration, and implant placement; more recent graduates performed more of these services. Formal advanced training correlated positively with soft tissue grafting, pocket reduction surgery, and bone and/or guided tissue regeneration. Hours of CE credits earned relating to periodontics correlated positively with crown lengthening and implant placement. The combined number of dental hygienist days per week correlated positively with all surgical therapies except crown lengthening.

Five groups of practice patterns emerged from a cluster analysis of the responses to the 11 periodontal therapies under investigation (Table 5). These groups were defined by the types of services rendered. Dentists in cluster 1 (N = 26) reported the greatest numbers of patients receiving all types of services; this was followed by cluster 2 (N = 72) and cluster 3 (N = 103). Dentists in cluster 1, representing 11% of GPs surveyed, reported that approximately six to 10 patients received some kind of surgical therapy in their practices within the last 3 months; all other GPs reported that near zero patients received surgical therapies. Dentists in cluster 3, representing 43% of

Table 4.
Pairwise Correlations Between Periodontal Services and Variables

Periodontal Service	Year of Dental School Graduation	Formal Advanced Dental Training*	Hours of CE Relating to Periodontics Earned Within Last 5 Years	Combined Number of Days per Week Dental Hygienists Work	Periodontal Disease Prevalence (excluding gingivitis)	Most Frequent Reasons for Referral to a Periodontist†
Multivariate P value	0.2637	0.0389	0.0104	<0.0001	0.0004	0.0064
Localized scaling and root planing (1 to 3 teeth)	0.00	0.08	0.05	0.25‡	0.19‡	-0.09
Generalized scaling and root planing (4+ teeth)	0.06	0.10	0.07	0.19‡	0.30‡	-0.17‡
Periodontal maintenance	0.05	0.11	0.21‡	0.29‡	0.17‡	-0.21‡
Site-specific therapy using chemotherapeutic agent	0.14‡	0.11	0.18‡	0.29‡	0.12	-0.31
Low-dose antibiotic	0.11	0.01	0.02	0.10	0.21‡	-0.07
Occlusal therapy	0.02	0.14‡	0.2‡	0.24‡	0.16‡	-0.10
Surgical crown lengthening	0.13	0.13	0.14‡	0.12	0.12	0.00
Soft tissue grafting	0.15‡	0.19‡	0.15‡	0.16‡	0.13‡	-0.05
Surgical periodontal therapy for pocket reduction	0.20‡	0.24‡	0.18‡	0.22‡	0.09	-0.03
Bone and/or guided tissue regeneration	0.19‡	0.17‡	0.17‡	0.19‡	0.07	0.01
Implant placement	0.18‡	0.12	0.19‡	0.17‡	0.03	-0.04

Bold values remained significant in the stepwise multiple regression.
 * Coded as some versus none.
 † Coded as yes or no, according to whether it was one of the four most frequent reasons for referral.
 ‡ Significant correlation in univariate regression (uncorrected P value <0.05).

GPs surveyed, indicated that one to five patients received group A services. The patterns that distinguished cluster 4 (N = 24) from cluster 5 (N = 16) were that dentists in cluster 4 had the highest possible levels of scaling and root planing and very little use of group B services. Dentists in cluster 5 also reported little use of low-dose antibiotic and occlusal therapies, but high use of scaling and root planing, periodontal maintenance, and site-specific therapy using chemotherapeutic agents.

Scaling and root planing was done by the GP or dental hygienist. Three practice patterns emerged regarding this periodontal service by asking “In your practice, what percentage of scaling and root planing, for example, are performed by the dentist versus the dental hygienist?” Twenty-four percent (56/232) of GPs reported that almost all (≥90%) of the scaling and root planing was done by the dentist, and thus <10% was done by the hygienists; 58% (135/232) of GPs reported that almost all (≥90%) of the scaling and root planing was done by the hygienists, and thus <10% was done by the dentists; and 18% (41/232) of

GPs reported >10% but <90% of scaling and root planing was done by the dentist.

Dentists indicated the most frequent reasons for referral to a periodontist. The percentages of responses for the eight choices are shown in Table 6. Scaling and root planing, periodontal maintenance, site-specific therapy using chemotherapeutic agents, and low-dose antibiotic were grouped together as “non-surgical periodontal therapy.” The most common reason for referral to a periodontist was surgical therapy for pocket reduction (90%). More than 50% of GPs indicated that they refer for some type of surgical therapy, whereas 34% refer for non-surgical therapy. Four percent of GPs refer for occlusal therapies.

Variables affected the types of periodontal services referred to periodontists. Referral for non-surgical periodontal therapy related negatively to the year of dental school graduation (P = 0.0138). Dentists who graduated in 1970 had a predicted probability of referral of 44%, whereas 1990 graduates’ referral probability was 29%. Referral for occlusal therapy related to combined number of dental hygienist days per week

Table 5.
Five Clusters of Practice Patterns

Periodontal Service	Cluster 1 (n = 26)			Cluster 2 (n = 72)			Cluster 3 (n = 103)			Cluster 4 (n = 24)			Cluster 5 (n = 16)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Scaling and root planing (1 to 3 teeth)*	3.9	1.0	2-5	2.4	0.8	1-4	2.1	0.6	1-5	5.0	0.0	5-5	3.6	1.2	2-5
Scaling and root planing (4 + teeth)*	4.0	1.0	2-5	3.0	0.9	1-5	2.1	0.6	1-4	4.9	0.3	4-5	3.8	0.9	2-5
Periodontal maintenance only*	4.4	0.7	3-5	3.5	0.9	2-5	1.9	0.7	1-3	3.6	1.4	1-5	4.3	0.8	2-5
Site-specific therapy using chemotherapeutic agent†	3.4	1.3	1-5	2.1	0.9	1-4	1.4	0.7	1-5	1.5	0.6	1-3	3.9	1.1	2-5
Use of low-dose antibiotic†	2.4	1.5	1-5	2.0	1.1	1-5	1.3	0.5	1-3	2.0	1.2	1-5	1.1	0.3	1-2
Occlusal therapies†	2.9	1.3	1-5	1.9	0.7	1-4	1.9	0.8	1-4	2.0	1.1	1-5	2.7	1.3	1-5
Surgical crown lengthening, gingivectomy†	2.6	1.2	1-5	1.7	0.9	1-5	1.5	0.5	1-3	1.4	0.6	1-3	1.3	0.5	1-2
Soft tissue grafting†	2.1	1.2	1-5	1.0	0.1	1-2	1.2	0.5	1-4	1.0	0.2	1-2	1.0	0.0	1-1
Surgical periodontal therapies†	2.4	0.9	1-5	1.2	0.4	1-3	1.2	0.4	1-2	1.0	0.2	1-2	1.1	0.4	1-2
Bone and/or guided tissue regeneration†	1.8	0.9	1-5	1.0	0.2	1-2	1.1	0.3	1-2	1.0	0.2	1-2	1.1	0.3	1-2
Implant placement†	2.3	1.5	1-5	1.1	0.3	1-2	1.2	0.6	1-5	1.1	0.3	1-2	1.0	0.0	1-1
Average of first three items*	4.1	0.7	3-5	3.0	0.6	2-4	2.0	0.5	1-3	4.5	0.5	3-5	3.9	0.7	3-5
Average of second three items†	2.9	1.0	1-5	2.0	0.6	1-3	1.5	0.4	1-3	1.8	0.7	1-4	2.6	0.3	2-3
Average of last five items†	2.2	0.7	1-4	1.2	0.2	1-2	1.2	0.3	1-3	1.1	0.2	1-2	1.1	0.2	1-2
Average of all items	2.9	0.5	2-5	1.9	0.3	1-3	1.5	0.3	1-3	2.2	0.3	2-3	2.3	0.2	2-3

* Scored as: 1 = 0 patients; 2 = 1 to 12 patients; 3 = 13 to 24 patients; 4 = 25 to 36 patients; and 5 = >36 patients.

† Scored as: 1 = 0 patients; 2 = 1 to 5 patients; 3 = 6 to 10 patients; 4 = 11 to 15 patients; and 5 = >15 patients.

($P = 0.0493$); GPs with more than seven combined days essentially never referring (1%) and those with one or fewer combined days referring 9% of the time. Referral for soft tissue grafting related negatively to the year of graduation from dental school ($P = 0.0076$). Dentists graduating in 1970 had a predicted probability of referral of 69%, whereas 1990 graduates' referral probability was 84%. Referral for bone and/or guided tissue regeneration was related to the year of graduation ($P = 0.006$). Dentists graduating in 1970 had a predicted probability of referral of 43%, whereas 1990 graduates' referral probability was 56%. Less recent graduates also had a higher referral rate; 1950 graduates had a referral probability of 65%. Referral for implant placement was related to whether the dentist had received formal advanced dental training ($P = 0.0279$). Those with no formal training referred

less often than did those with formal training (47% versus 62%). Increased referral seemed to be associated with AEGD training, in particular ($P = 0.0577$). Referrals for crown lengthening and surgical pocket reduction surgery had no apparent relationship to any of the variables.

DISCUSSION

The dental literature lacks information about the types of periodontal services rendered by GPs. This study was designed to gather information about the types of periodontal services performed by GPs practicing within the state of Virginia and the dental hygienists that they employ. A primary aim of this study was to determine whether certain variables affected periodontal services rendered by GPs and their referral patterns.

Table 6.
Reasons for Referral to a Periodontist

Reason	N	%
Non-surgical periodontal therapy*	82	34
Occlusal therapy	10	4
Surgical crown lengthening	126	52
Soft tissue grafting	187	78
Surgical periodontal therapy for pocket reduction	217	90
Bone and/or guided tissue regeneration	125	52
Implant placement	129	54
Other	6	2

Percentage calculated from 241 survey responders.

* Non-surgical periodontal therapy included scaling and root planing, periodontal maintenance, site-specific therapy using chemotherapeutic agent, and low-dose antibiotic.

All of the periodontal services under investigation were offered by most GPs to some extent. Although there was great variety in practice patterns, unique service groupings did emerge from correlation analysis. That is, if a general dentist reported that he/she performed high numbers of one procedure within a group, then he/she also performed high numbers of the other procedures in the group (referred to as groups A, B, and C for discussion purposes).

The non-surgical mechanical therapies correlated highly; therefore, they were grouped together (group A). Because the knowledge and technical skills that are needed to manage periodontal patients and perform non-surgical mechanical therapies are quite similar, it is not surprising that these services correlated highly. Overall, these services were rendered the most commonly in GP offices; nearly 20% of GPs reported treating >36 patients with scaling and root planing or periodontal maintenance over a 3-month period.

Site-specific therapy using chemotherapeutic agents, low-dose antibiotic, and occlusal therapies made up group B. Although the indications and technical skills that are involved with these therapies are quite different, these services are used often when other types of therapies do not reach the endpoint of treatment. Within group B services, occlusal therapies were the most common type of services offered by GPs; half of them reported treating one to five patients over a 3-month period.

All types of surgical services are grouped together as group C. Some of these surgical services are used to treat periodontal disease, others are preprosthetic in nature, and still others may be used to enhance den-

tal esthetics. Although the indications and technical skills that are needed to perform these various surgical services and manage patients afterwards are quite different, all surgical procedures were correlated. A small group of GPs (cluster 1, N = 26) rendered the majority of surgical services. Crown lengthening was the most common type of surgical therapy performed by GPs, followed by pocket reduction surgery.

Certain variables affected the specific types of services rendered by GPs. Year of dental school graduation, training beyond dental school, and combined number of dental hygienist days per week were related to certain periodontal services rendered. If a GP reported a more recent graduation date, he/she also reported providing greater numbers of certain periodontal services. Conversely, there was an inverse relationship between referral for certain services and rendering that service.

Year of dental school graduation correlated with three surgical services (pocket reduction surgery, bone and guided tissue regeneration, and implant placement). Similar to the study by Betof et al.,⁹ younger dentists, presumably more recent graduates, treated more patients with periodontal disease than did less recent graduates. In the present study, more patients had implants placed by more recent graduates compared to graduates from the 1970s. Implant dentistry was part of recent graduates' training;¹³ therefore, they may be more familiar with the vast amount of knowledge and technical information that are available in this area.

Training beyond dental school (formal advanced training programs or recent CE earned relating to periodontics) also was related to the surgical services. CE earned, but not participation in a formal advanced training program, was related to performing crown lengthening or implant placement procedures. The majority of GPs surveyed did not participate in a formal advanced training program beyond dental school. Those who did may not have attended a program that prepared them adequately for these services, or they may not desire to treat patients in these ways, assuming that there are patients needing such services in their practices.

The combined number of dental hygienist days per week was related to all services, except use of low-dose antibiotic and crown lengthening. This is not surprising, because these services are out of the scope of practice for dental hygienists. However, other services out of the scope of practice for dental hygienists, such as occlusal adjustment and implant placement, were related to number of hygienist days. It may be that GPs with more hygienist contact hours in their practices are able to engage in other and more complex therapies while the dental hygienist devotes him/herself to procedures that he/she is trained to do. GPs with more

hygienists are likely to treat more patients, and, based on volume, these GPs may perform more periodontal therapies, including the replacement of missing teeth with dental implants.

An inverse relationship was found between periodontal services rendered by GPs and referral for these procedures. For example, GPs who referred for generalized scaling and root planing reported treating zero patients or one to five patients with this procedure. Therefore, dentists who commonly refer certain procedures tend to treat low numbers of patients in these ways.

The average GP in this study reported that 28% of his/her patients had periodontitis. Other investigators reported similar findings in the United States population. Oliver et al.¹⁴ found that 30% of the population had periodontitis, defined as periodontal pockets ≥ 4 mm. Albandar¹⁵ estimated that 48% of adults in the United States have chronic periodontitis. In the present study, dentists who reported more patients with periodontal disease treated more patients with low-dose antibiotic and performed more scaling and root planing, periodontal maintenance, and occlusal therapies, but did not treat their periodontal patients surgically. Dentists who refer to a periodontist for non-surgical therapy saw fewer patients for generalized scaling and root planing (four or more teeth), periodontal maintenance, and site-specific therapy using chemotherapeutic agents.

The most common reasons for referral included surgical therapy for pocket reduction, soft tissue grafting, implant placement, surgical crown lengthening, and bone and/or guided tissue regeneration. The findings here are similar to those reported recently in another study involving GPs practicing within the state of Virginia.¹⁰ The most common reasons for referral in that study were treatment of generalized and localized disease, soft tissue grafting, and crown lengthening. In comparing the findings, on a percentage basis, differences of $\geq 20\%$ emerged for two services (bone grafting and soft tissue grafting). In both cases, dentists who participated in this study indicated that they refer for bone grafting and soft tissue grafting services more commonly than did dentists involved in the previous study. This is likely due to the way in which these services were defined, rather than true differences in referral patterns. For example, soft tissue grafting in this current study was defined as “pedicle [D4270], free gingival graft, [D4271], connective tissue graft [D4279], allograft [D4275], connective tissue plus pedicle graft [D4276].” Therefore, this study’s definitions were more inclusive.

Three variables under investigation in this study influenced referral patterns: year of dental school graduation, formal advanced training, and combined number of hygienist days. More recent graduates

tended not to refer for non-surgical periodontal services, defined as scaling and root planing, periodontal maintenance, site-specific therapy using chemotherapeutic agents, and low-dose antibiotic. Contemporary dental students’ clinical and didactic curricula include all of these services, whereas graduates of the 1970s would not have been exposed to services such as site-specific therapy using chemotherapeutic agents and low-dose antibiotic. Non-surgical therapy or soft tissue management programs may be more appealing to more recent graduates whose practice base is not as well established as those who have been in practice for many years. However, more recent graduates indicated that they commonly refer for soft tissue grafting and bone and/or guided tissue regeneration services compared to less recent graduates. These services are associated often with esthetic and implant dentistry. It may be that more recent graduates are more attentive to these areas of dentistry. However, the four graduates of the 1950s indicated that they refer often for bone and/or guided tissue regeneration.

Formal advanced training also influenced referral to a periodontist. The GPs in this study who had formal advanced training, particularly AEGD training, referred for implant placement more often than did dentists without such formal training. Although formal training programs may emphasize the surgical and restorative techniques that are associated with implant dentistry, others may focus on only the restorative aspects. This could enhance the number of referrals to specialists for the surgical services associated with implant therapy. Additionally, dentists who are trained in all aspects of implant dentistry during their formal training may elect not to perform the surgical aspects of implant dentistry for a variety of reasons, including cost of materials, patient management, and lack of professional collaboration.

Combined number of dental hygienist days per week was another variable that impacted referral patterns. Although only a few GPs commonly referred for occlusal therapies (9% of study population), combined number of dental hygienist days per week affected this type of referral. Those GPs with one or fewer hygienist combined days per week referred for occlusal therapies, whereas those with more than 7 combined days essentially never referred for occlusal therapies. Dentists who employ fewer dental hygienists may be busy rendering services that may otherwise be performed by the dental hygienist, and, thus, opt to refer some services. Data collected as part of this investigation were similar to that collected by a national survey of the American Dental Association. Nationally, 73% of GPs employed a dental hygienist. In this study, 83% of GPs employed at least one hygienist. Nationally, 13% of dentists are younger than 35 years of age. In this study, 26% of GPs reported that they graduated

from dental school after 1990. It is likely that most of these dentists are younger than 35 years old.

The survey instrument used here did not ask GPs to identify themselves as male or female or to classify their practice location as urban, suburban, or rural. It may have been worthwhile to have investigated differences in gender and practice location for services rendered and referral patterns. A recent article reported that female GPs referred more often for periodontal services than did male GPs.¹⁰ Betof et al.⁹ found that dentists practicing in an urban location referred more frequently than did dentists in a rural setting.

This study is based on GPs' self-reported data and may overestimate the number of periodontal procedures provided for two reasons. First, GPs were not encouraged to refer to actual practice records regarding services rendered. Therefore, the data gathered likely are based on the GPs' recall of practice patterns and represent estimates of services rendered. Previous studies^{16,17} comparing practitioners' self-reported data and actual health care records found that practitioners tended to overreport the quality or benefit of their treatment practices. Thus, the services reported here may be overestimates of periodontal therapies rendered by GPs. Another consideration of a survey of this type is that GPs who render periodontal services probably are more likely to complete the survey compared to GPs who provide few periodontal services or none at all. This could lead to a selection bias and an overestimation of services rendered.

This study's response rate of 63.1% was similar to other survey studies^{9,10,18,19} of its kind. Attempts were made to enhance participation by using the following design strategies. A cover letter, emphasizing the purpose of the study and confidentiality of responses, accompanied each survey. The survey was brief, consisting of only 13 multiple choice questions. Focus group pretesting indicated that it took no more than 20 minutes to complete. Three mailing cycles, using a postage-paid preaddressed return envelope, also was intended to enhance the response rate.

CONCLUSIONS

A variety of periodontal services was offered in general practice offices. Scaling and root planing and periodontal maintenance were among the most common services in general dental offices; they were offered by >85% of GPs surveyed. Twenty-four to 30% of GPs rendered these services to ≥ 13 patients in a 3-month period. More patients received localized scaling and root planing (one to three teeth) than generalized scaling and root planing (four or more teeth). About half of GPs reported that $\geq 90\%$ of scaling and root planing was performed by the dental hygienist. Overall, a small percentage of patients are seen by GPs for periodontal surgical services, and these services are per-

formed mostly by a small group of dentists. Year of dental school graduation, recent CE credits earned relating to periodontics, combined number of dental hygienist days per week, percentage of periodontal patients in practice, and referral for non-surgical periodontal therapy affected periodontal services rendered in general practice offices. GPs refer most commonly for surgical therapy for pocket reduction, soft tissue grafting, implant placement, surgical crown lengthening, and bone and/or guided tissue regeneration. Year of dental school graduation, formal advanced training, and combined number of hygienist days per week affected the types of services referred to periodontists.

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