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Perception of soft tissue laser use in orthodontic practice: a survey of orthodontists, periodontists, and general dentists

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Perceptions of Soft Tissue Laser Use in Orthodontic Practice: a Survey of Orthodontists, Periodontists, and General Dentists

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry at Virginia Commonwealth University.

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Table of Contents

List of Tables

List of Figures

Abstract

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Recently, soft tissue lasers have been introduced into orthodontic practice to perform procedures that were traditionally referred to other dental professionals. The purpose of this study was to compare the attitudes of orthodontists, periodontists, and general dentists regarding the use of soft tissue lasers by orthodontists. The ultimate goal was to facilitate communication among dental professionals and improve the care of orthodontic patients requiring management of soft tissues.

A survey was developed to evaluate and compare the current opinions of orthodontists (n=330), periodontists (n=171), and general dentists (n=77) regarding orthodontists' use of soft tissue lasers.

When compared to orthodontists and general dentists, a lower percentage of periodontists indicated that soft tissue laser use by orthodontists was appropriate (P = 0.001). Also, for each of the 8 specific soft tissue laser procedures investigated,

periodontists reported a significantly lower level (P = 0.001) of appropriateness than did orthodontists and general dentists.

Longer version of Abstract

***Introduction*:** The oral soft tissues can become an impediment to expeditious and timely finishing of orthodontic cases as well as negatively impact the esthetics of finished results. Recently, soft tissue lasers have been introduced into orthodontic practice to perform procedures that were historically referred to other dental professionals. The purpose of this study was to compare the attitudes of orthodontists, periodontists, and general dentists regarding the use of soft tissue lasers by orthodontists. The ultimate goal was to facilitate communication among dental professionals and improve the care of orthodontic patients requiring management of soft tissues.

***Methods*:** A survey was developed to evaluate and compare the current opinions of orthodontists (n=330), periodontists (n=171), and general dentists (n=77) regarding orthodontists' use of soft tissue lasers.

***Results*:** When compared to orthodontists and general dentists, a lower percentage of periodontists indicated that soft tissue laser use by orthodontists was appropriate (P = 0.001). Also, for each of the 8 specific soft tissue laser procedures investigated, periodontists reported a significantly lower level (P = 0.001) of appropriateness than did orthodontists and general dentists. Overall, 28% of orthodontists, periodontists, and general dentists surveyed said they used a soft tissue laser and this percentage did not differ significantly among groups (P = 0.56). Of the 3 groups of practitioners, 78%

believed that there would be no effect on referrals to orthodontists who use a soft tissue laser, while 11% said that referrals would increase and 11% said that referrals would decrease. However, these percentages were different among practitioner groups with orthodontists more likely to think that referrals would increase ($P = 0.0026$) while periodontists were more likely to believe that referrals would decrease ($P < 0.001$).

Conclusions: Orthodontists, periodontists, and general dentists were equally likely to use a soft tissue laser. However, these 3 groups differed in their opinions of the perceived appropriateness of soft tissue laser use by orthodontists with periodontists reporting a lower level of appropriateness when compared to orthodontists and general dentists. Regardless of which practitioner uses a soft tissue laser, orthodontists, periodontists, and general dentists need to communicate effectively to ensure that the orthodontic patient in need of adjunctive soft tissue surgery is treated to the accepted standard of care.

Introduction

The purpose of orthodontic treatment is to provide patients with results that are functional, esthetic, and stable. Although several problems such as delayed or altered passive eruption[1] and poor oral hygiene[2] can potentially prolong orthodontic treatment, orthodontists strive to accomplish their treatment goals in as timely a manner as possible in order to reduce the number of appointments and overall time in active treatment. Doing so results in increased practice efficiency and productivity as well as satisfaction of patients' demands to finish treatment as expeditiously as possible. There are also health benefits to reduced treatment time. As orthodontic treatment duration increases, patients are at greater risk of root resorption[3] and their motivation for compliance and cooperation may decrease, perhaps resulting in an increased risk of caries and periodontal disease.[4]

Even in patients exhibiting good oral hygiene and low plaque scores, a majority of those in fixed orthodontic appliances have mild to moderate generalized gingivitis with accompanying increases in pocket depths and hyperplastic gingiva.[5] Gingival overgrowth results from an increase in plaque retention sites accompanying the presence of fixed orthodontic appliances. These appliances often encroach on the gingival margin, making optimal hygiene very difficult. The situation is potentially worsened by the increased risk of enamel decalcification resulting in white spot lesions due to the patients' inability to remove the plaque biofilm from underneath the overgrown gingiva. The pH of plaque is lower,[6,7] and the incidence of white spot lesions is higher,[8] in orthodontic patients than in other individuals.

One of the primary objectives of orthodontics is to improve dental and facial esthetics. Since the latter part of the 20th century, there has been a trend for a heightened awareness of dentofacial esthetics.[9] This concept extends far beyond the ideals of straight, white teeth. Consideration of the facial soft tissues, including those intimately associated with the teeth (ie. the gingiva), is important when making a thorough diagnosis and developing a treatment plan aimed at achieving the highest standards in esthetics.[10]

Although subjective in nature, dental and smile esthetics have been shown to have an objective, quantitative component. There are published data describing standards for tooth size proportions,[11] the relationship of the upper lip to the gingival margin (ie. gingival smile line),[12,13] the location of the gingival zenith,[14,15] and symmetry of gingival contours,[16,17] which can guide the clinician in treatment planning decisions.

Recently, the diode laser has been integrated into orthodontic practice and published reports demonstrate its usefulness for addressing the esthetic and other soft tissue challenges facing orthodontists.[1,18-21] The use of lasers in dentistry is not a new concept. Since the 1960s, researchers and clinicians have explored the possibilities of replacing conventional treatment techniques with lasers in the hopes of improving patient care. The first publications focused primarily on the treatment of dental caries,[22,23] but the decades that followed brought increased attention to treating the oral soft tissues.[24-33]

Comparatively, the use of lasers by orthodontists is relatively new. In 2004, Hilgers and Tracey[18] published a review article combined with case reports illustrating some applications of the diode laser in orthodontic practice. The authors cited cost-effectiveness, ease of use, positive patient response, and impact on esthetic results to

support their prediction that the diode laser would soon gain wide acceptance in orthodontic practice to treat challenging soft tissue problems frequently seen in patients. Elaborating further on the advantages of a diode laser in orthodontic practice, Sarver[20] cited good hemostasis, reduced potential for infection, lack of damage to teeth and bone due to the laser's affinity for soft tissue only, and no need for local anesthesia. He also stated that, "orthodontic procedures can be accomplished in less time and in fewer visits." In part three of a 3-part series entitled, "Principles of Cosmetic Dentistry in Orthodontics," Sarver and Yanosky[1] concluded that their use of a diode laser in orthodontic practice had resulted in improved esthetics of their cases and increased the efficiency of treatment.

The diode laser is used by orthodontists to perform cosmetic gingival contouring, exposure of teeth to facilitate eruption, frenectomy, gingivectomy, gingivoplasty, operculectomy, the removal of redundant tissue due to poor oral hygiene or space closure, removal of soft tissue to uncover temporary anchorage devices, and the treatment of aphthous ulcers or herpetic lesions.[1,18-21] As the popularity of this new technology increases, it is likely that more orthodontists will perform soft tissue procedures that were traditionally referred to other dental professionals. At present, there are no data that report the perceptions of orthodontists and other dental professionals regarding the use of soft tissue lasers in orthodontic practice. Such information may help in the establishment of guidelines for appropriate laser use by orthodontists. The purpose of this investigation was to gather information about the attitudes of orthodontists, periodontists, and general dentists toward the use of soft tissue lasers by orthodontists. Of specific interest were the

opinions of the 3 groups regarding whether or not an orthodontist should be using a soft tissue laser in practice and, if so, the specific procedures thought to be appropriate. Responses were compared among groups to identify areas where differences in opinion occurred. The goal was to facilitate communication among dental professionals and ultimately improve the care of orthodontic patients requiring management of soft tissues.

Materials and Methods

Analogous surveys were distributed to 3 different groups of dental professionals who may be affected by the use of soft tissue lasers in orthodontics: orthodontists, periodontists, and general dentists. In order to improve the survey's design and thereby increase the rate of response, it was pre-tested before implementation by surveying and consulting full- and part-time faculty members from the Virginia Commonwealth University departments of Orthodontics, Periodontics, and General Practice. Institutional Review Board approval was granted to conduct the study. The front page of each survey contained the title of the study and explained its purpose.

The American Association of Orthodontists (AAO) granted permission and provided the names and addresses of 1,000 randomly selected, actively practicing orthodontists in the United States. Thirty of the addresses were not recognized by the post office as deliverable addresses. The surveys were mailed successfully to 970 orthodontists along with addressed postage-paid envelopes.

The American Academy of Periodontology (AAP) granted permission and provided the names and addresses of 1,000 randomly selected, actively practicing periodontists in the United States. Seventeen of the addresses were not recognized by the post office as deliverable addresses. The surveys were mailed successfully to 983 periodontists along with addressed postage-paid envelopes.

The American Dental Association (ADA) granted permission and provided the names and addresses of 1,000 actively practicing general dentists in the United States. Thirteen addresses were not recognized by the post office as deliverable addresses. The

surveys were mailed successfully to 987 general dentists along with addressed postage-paid envelopes.

For each of the 3 groups, orthodontists, periodontists, and general dentists, all 50 U.S. states were represented in the samples. The envelopes were numerically coded to identify non-respondents. When the surveys were returned, the envelopes were matched to the code list and separated to maintain confidentiality of the answers submitted. A follow-up survey was sent to those who did not return a questionnaire.

In each survey were 13 identical questions and 1 question asking each respective respondent whether they were an orthodontist, periodontist, or general dentist to confirm that the surveys were sent to the intended individual. With identical questions for the 3 surveys, the responses could be directly compared.

The first section of the survey asked for demographic information such as gender, age, and the calendar year of graduation from dental school for each of the 3 practitioner groups. The second section included 8 questions asking how appropriate the respondent felt it was for an orthodontist to perform the various soft tissue laser procedures that have been reported in the orthodontic literature.[1,18-21] To answer these questions, the respondents were asked to make a vertical mark on a 100 mm visual analog scale (VAS) with one extreme of the scale marked "inappropriate" and the other extreme labeled "appropriate." Following a question about referral patterns, the survey asked whether or not the person surveyed uses a soft tissue laser in his/her practice. If the answer was yes, he/she was prompted to continue to the final section of the survey. Otherwise, the respondent was finished with the survey. The final section, for those actively using a soft

tissue laser, included questions pertaining to the procedures performed, type and amount of training received, frequency of use, whether fees are assessed for services provided, and perceived advantages of laser use. Each survey provided a section for written comments.

The data were entered into an Excel spreadsheet (Microsoft, Redmond WA) and the 3 groups were compared using a chi-square test or ANOVA, as indicated by the outcome variable, with significance set at $P < 0.05$. All analyses were performed using SAS software (JMP version 8.0.2, SAS Institute Inc, Cary, NC).

Results

A total of 538 (18%) surveys were returned. These included responses from 330 orthodontists (34% return rate), 131 periodontists (13% return rate), and 77 general dentists (8% return rate). The demographic characteristics of the respondents are described in Table I. Overall, the respondents were 85% male, but this percentage was significantly different among the 3 groups ($P = 0.0044$) with a lower proportion of male general dentists (72%) and a higher proportion of male orthodontists (88%) and periodontists (84%). The groups also differed by age ($P < 0.001$) and year of graduation ($P < 0.001$). General dentists and periodontists were similar in age and year of graduation while orthodontists were older and graduated earlier on average than the other 2 groups.

Table I. Demographics of survey respondents

	Orthodontist	Periodontist	General Dentist
Gender			
Male:Female	291:39	110:21	55:21
% Male	88%	84%	72%
Age			
Mean (SD)	53.8 (4.1)	49.6 (8.5)	45.8 (11.6)
Range	31-68	30-65	26-65
Year of graduation			
Mean (SD)	1985 (3.4)	1991 (9.2)	1990 (11.6)
Range	1967-2007	1969-2008	1969-2008

Perceived Appropriateness of Soft Tissue Laser Use

The primary questions of the survey pertained to the perceived appropriateness of soft-tissue laser use by orthodontists. Eight clinical procedures were investigated and are detailed in Table II. The perceived appropriateness of each of these procedures was quantified using a 100 mm VAS, with lower scores indicating a lower level of appropriateness. Overall, for the 3 groups, the percentage of those believing it was appropriate for a soft tissue laser to be used by an orthodontist was 84%. General dentists and orthodontists did not differ significantly from each other (88% and 93%, respectively), but there was a significant difference ($P < 0.001$) between these 2 groups and periodontists (59%).

Significant differences were found among the 3 groups for each of the 8 soft tissue laser procedures when the VAS scores measuring perceived appropriateness were compared ($P < 0.001$). The results are shown in Table II. In all cases, periodontists recorded significantly lower scores than both orthodontists and general dentists ($P < 0.001$). For 2 procedures, gingivectomy to enhance esthetics and operculectomy, orthodontists had significantly higher scores ($P < 0.001$) than both periodontists and general dentists. No significant differences were detected related to gender ($P = 0.56$), age ($P = 0.61$), or year of graduation ($P = 0.98$).

Table II. VAS means and 95% confidence intervals (CI)

	Orthodontist		Periodontist		General Dentist	
	Mean VAS	95% CI	Mean VAS	95% CI	Mean VAS	95% CI
Gingivectomy to improve/facilitate hygiene around brackets/bands	76.6	72.9-80.3	47.1*	39.2-54.9	69.0	60.6-77.5
Gingivectomy to enhance esthetics by improving gingival symmetry or tooth size proportions	72.5**	68.5-76.5	32.0*	24.7-39.3	62.9	53.6-72.1
Operculectomy	76.6**	72.8-80.3	46.7*	38.8-54.6	67.0	58.1-75.9
Uncovering TADs due to overgrowth of mobile mucosa	80.3	76.8-83.9	52.8*	45.3-60.3	78.4	70.9-85.8
Removal of keratinized gingiva for proper bracket positioning on incompletely erupted teeth	76.4	72.4-80.4	34.9*	27.9-41.9	71.3	62.5-80.0
Removal of keratinized gingiva to expose unerupted teeth	73.2	69.2-77.3	23.0*	17.0-29.0	63.8	54.5-73.0
Frenectomy	52.7	48.3-57.1	38.4*	31.0-45.7	59.6	50.2-69.0
Ablation of aphthous ulcers	58.8	54.5-63.3	46.9*	39.2-54.5	53.8	44.4-63.3

** Statistically significant difference compared to orthodontists and general dentists, p<0.001*
*** Statistically significant difference compared to periodontists and general dentists, p<0.001*

The prevalence of laser use within the 3 practitioner groups is shown in Figure 1. Overall, 28% of orthodontists, periodontists, and general dentists surveyed said they used a soft tissue laser and this percentage did not differ significantly among groups (P = 0.56). For general dentists, there was no relationship between whether they use a soft tissue laser and their perceived appropriateness of laser use by orthodontists (P = 0.45). However, a significant relationship did exist within both the orthodontist (P = 0.001) and periodontist (P = 0.0076) groups. Within orthodontists, all those who thought it inappropriate to use a soft tissue laser said they do not use lasers, while 71% of orthodontists who expressed that laser use is appropriate reported that they use a laser in their own practice. Figure 2 illustrates the observed differences for periodontists. Of the 69% of periodontists that do not use a soft tissue laser in their practice, the number who thought it appropriate (35%) for orthodontists to use a soft tissue laser was about even with the number who thought it inappropriate (34%). Conversely, for the 31% of periodontists who do use a soft tissue laser in their practice, the number who approved of orthodontists' use of a soft tissue laser (24%) was over 3 times as high as the number who disapproved (7%).

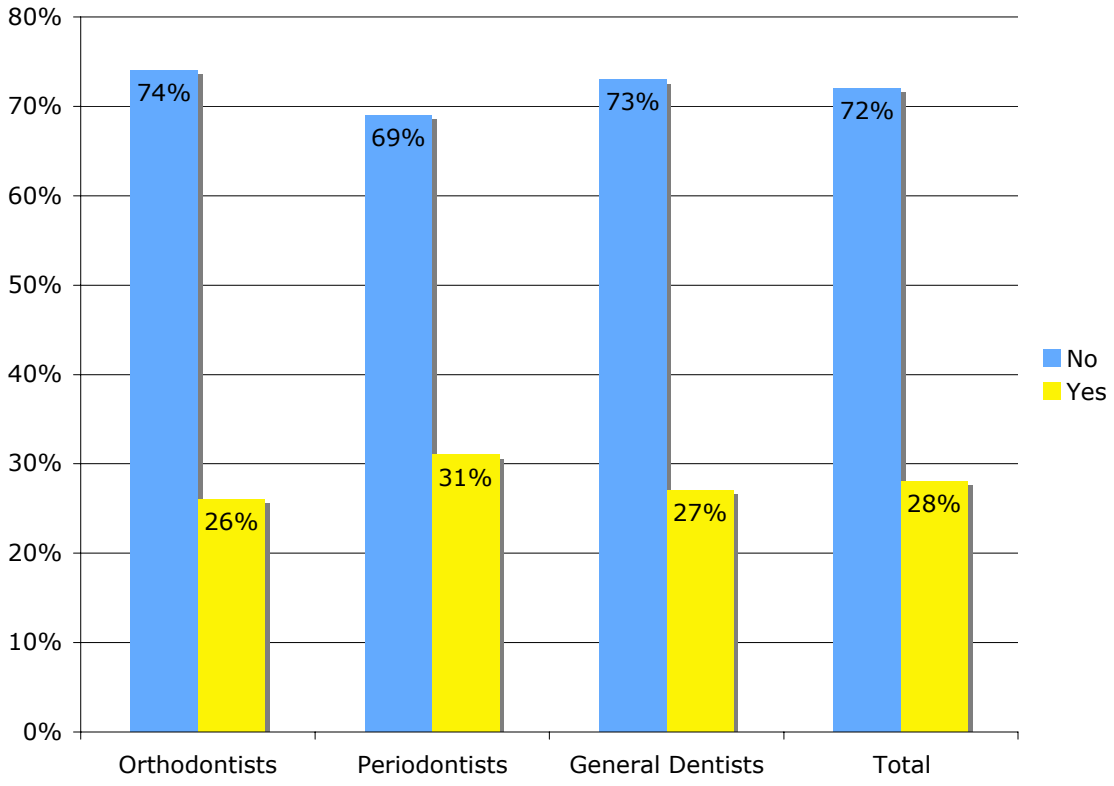
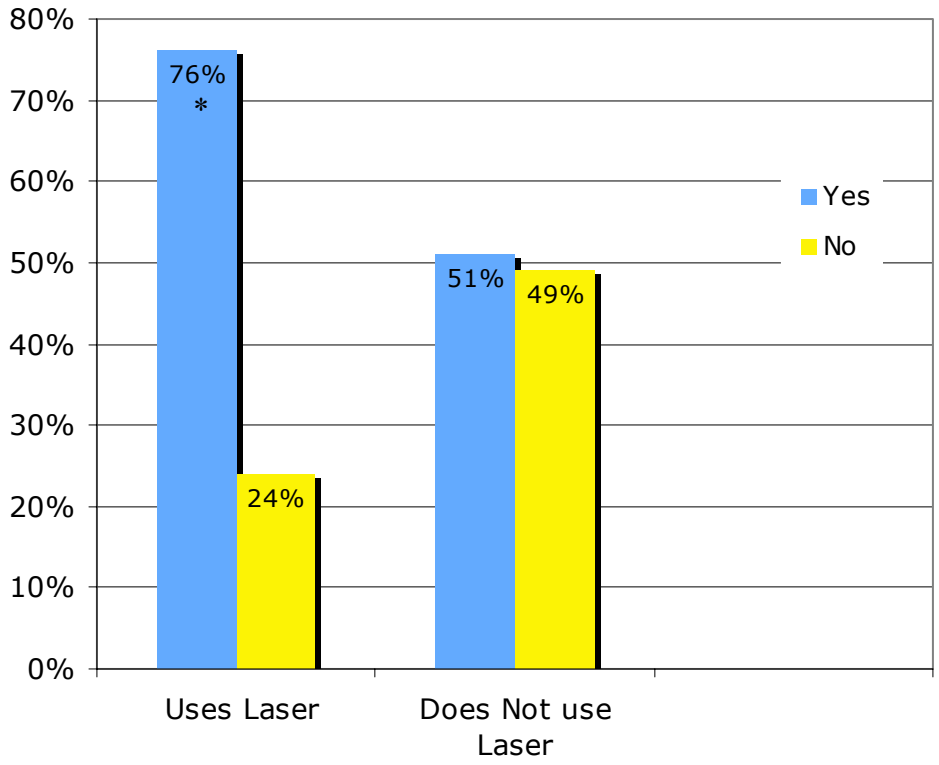


Figure 1. Prevalence of soft tissue laser use among survey respondents

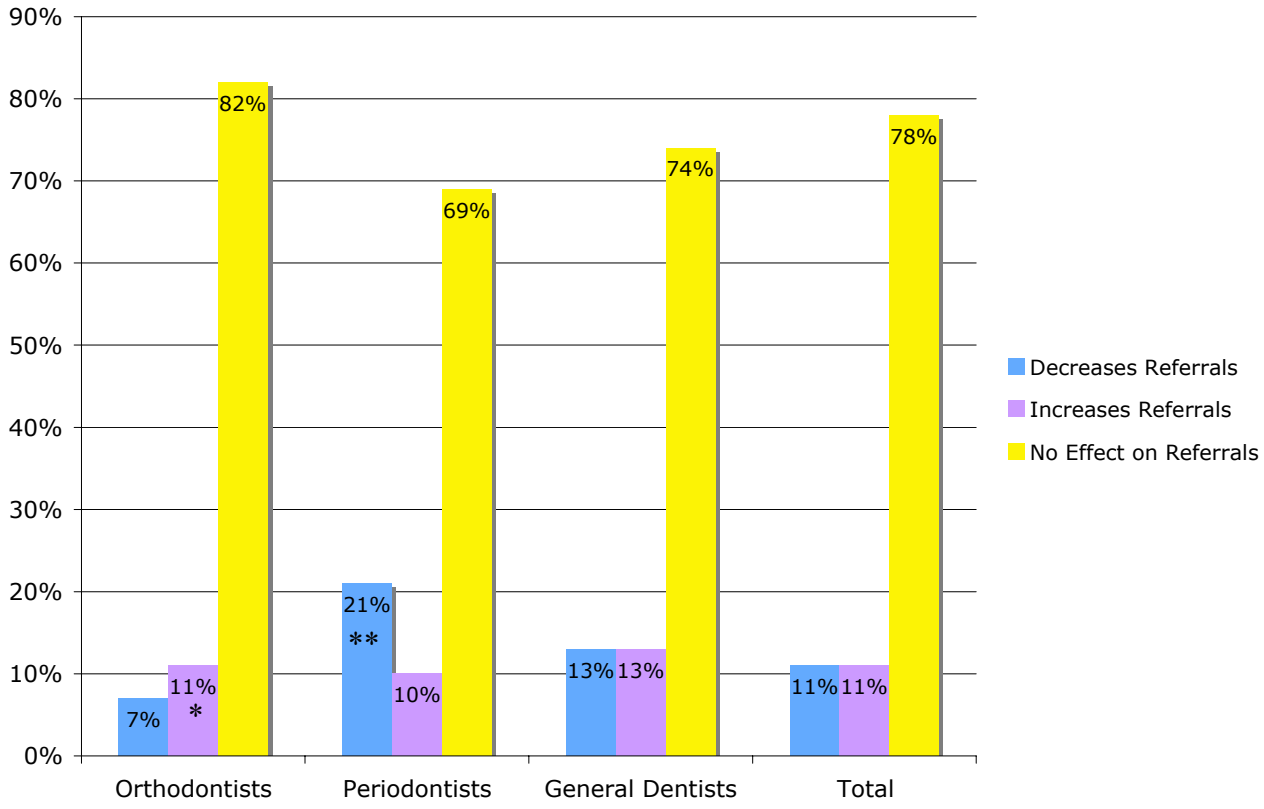


* Statistically significant difference p=0.0076

Figure 2. Relationship between periodontists' use of soft tissue lasers and perceived appropriateness of soft tissue laser use by orthodontists

Effect of Soft Tissue Laser Use on Referral Patterns

Figure 3 illustrates the perceived effect of orthodontists' laser use on referrals to their practice. Overall, of the 3 groups of practitioners, 78% believed that there would be no effect on referrals to orthodontists who use a soft tissue laser, while 11% said that referrals would increase and 11% said that referrals would decrease. However, these percentages were different among practitioner groups. For general dentists, there were equal numbers who thought referrals would either increase or decrease (about 13% each), but orthodontists were more likely to believe that laser use would increase (11%), rather than decrease (7%) referrals to their practice ($P = 0.0026$) and more periodontists thought that referrals to orthodontists who use a soft tissue laser would decrease (21% vs. 10%; $P < 0.001$).



** Statistically significant difference p=0.0026*
*** Statistically significant difference p<0.001*

Figure 3. The relationship between practitioner group and perceived effect on referrals to orthodontists who use a soft tissue laser

Procedures Performed with a Soft Tissue Laser

Those practitioners who use a soft-tissue laser in their practice were asked which procedures they performed. The results are shown in Table III. Orthodontists said they used soft tissue lasers more often than periodontists and general dentists to improve/facilitate hygiene ($P = 0.0074$). There was no difference among the 3 practitioner groups for performing either gingivectomy to enhance esthetics or operculectomy ($P > 0.64$). Orthodontists used soft tissue lasers more often than periodontists and general dentists for uncovering temporary anchorage devices (TADs), removal of keratinized gingiva for proper bracket positioning, and exposure of unerupted teeth ($P < 0.001$), while there was no difference between general dentists and periodontists for performing these 3 procedures. For frenectomies, orthodontists used soft tissue lasers less often than general dentists and periodontists ($P < 0.001$), and ablation of aphthous ulcers was done slightly more by general dentists than the other 2 practitioner groups, but this difference was not significant ($P = 0.17$). Table IV includes a list of "other" procedures that were reported to be performed by the practitioners with a soft tissue laser.

Table III. Of those who use a soft tissue laser, the % of respondents whom reported performing the following procedures

	Orthodontists	Periodontists	General Dentists
Gingivectomy to improve/facilitate hygiene	90%*	71%	67%
Gingivectomy to enhance esthetics	83%	76%	81%
Operculectomy	67%	63%	67%
Uncovering TADs	62%**	44%	38%
Removal of keratinized gingiva for proper bracket positioning	90%**	61%	43%
Removal of keratinized gingiva to expose unerupted teeth	91%**	54%	43%
Frenectomy	39%**	88%	67%
Ablation of aphthous ulcers	45%	44%	67%

* P = 0.0074

** P = 0.001

Table IV. "Other" procedures listed by respondents

Procedure	Practitioner Group
Hard tissue treatment – bone and teeth	Periodontist
Laser assisted new attachment procedure (LANAP)	Periodontist
Periolase	Orthodontist
Minor canine uncovering	Orthodontist
Treatment of chronic adult periodontitis	Periodontist
Periolase, but it's not great for soft tissue procedures	Periodontist
I use blade, but laser to cauterize	Periodontist
Crown Lengthening	General dentist
Exposure of impacted cuspids	Orthodontist
Lingual Frenectomy	Periodontist
Uncover impacted cuspids	Orthodontist

Training

Table V shows the data for different types of soft tissue laser training reported by the practitioner groups. For those who said they used a laser in their practice, periodontists were much more likely to have been trained to use a soft tissue laser in a formal education setting ($P < 0.001$) than either general dentists or orthodontists (56% versus less than 14%). There was no difference among the 3 practitioner groups regarding training obtained from continuing education (CE) classes ($P = 0.39$), self-taught training ($P = 0.61$), training provided by sales staff ($P = 0.0533$), or company-sponsored training ($P = 0.40$).

Table V. Form of soft tissue laser training acquired by each practitioner group

Form of Training	Orthodontists	Periodontists	General Dentists	P value
Formal advanced dental program or residency program	9 (10%)	23 (56%)	3 (14%)	0.001
Continuing education	53 (61%)	22 (54%)	15 (71%)	0.39
Self-taught	33 (38%)	12 (29%)	8 (38%)	0.61
Instruction by sales staff	28 (32%)	6 (15%)	8 (38%)	0.0533
Company-sponsored certification course	44 (51%)	23 (56%)	8 (38%)	0.4

There was a significant difference among the 3 practitioner groups in the number of hours of soft tissue laser-related continuing education credits reportedly earned in the last 5 years ($P = 0.0006$). The results are shown in Table VI. Periodontists reported more

CE credit hours, with 44% of periodontists reporting more than 24 hours of CE and over 50% with at least 17 hours.

Table VI. Soft tissue laser CE credit hours earned in last 5 years

Credit Hours	Orthodontists	Periodontists	General Dentists	Total
0	11 (13%)	3 (7%)	3 (14%)	17 (11%)
1-8	38 (44%)	10 (24%)	7 (33%)	55 (37%)
9-16	20 (23%)	6 (15%)	5 (24%)	31 (21%)
17-24	12 (14%)	4 (10%)	2 (10%)	18 (12%)
>24	5 (6%)	18 (44%)*	4 (19%)	27 (18%)

* P = 0.0006

Frequency of Soft Tissue Laser Use

There was no significant difference among the 3 groups with regard to how often the soft tissue laser was used (P = 0.19), with most practitioners using it weekly.

Are Patients Charged a Fee for Soft Tissue Laser Procedures?

Not all practitioners reported that they charge a fee for soft tissue laser procedures and there was a significant difference among groups (P < 0.001). Ninety-five percent of periodontists and 80% of general dentists said they charge a fee ("yes" or "sometimes") compared to only 52% of orthodontists.

Discussion

The majority of respondents from within the orthodontist, periodontist, and general dentist groups surveyed approved of orthodontists using a soft tissue laser. Yet, there were differences in perceptions among the dental professional groups surveyed in this study. In general, periodontists were significantly less approving of orthodontists' use of soft tissue lasers than were both orthodontists and general dentists, with only 59% of periodontists approving, compared to 88% of general dentists and 93% of orthodontists. Periodontists generate revenue by performing services, both surgical and non-surgical, which are aimed at improving the health and esthetics of the oral soft tissues. Although not tested by the present study, it is possible that the lower rate of approval by periodontists could be related to the direct economic implications for periodontists as compared to either orthodontists or general dentists. Or, perhaps because they have more knowledge regarding the possible biological and clinical consequences of laser treatment, periodontists feel less confident in supporting the performance of such procedures by practitioners with less training.

In addition, periodontists' viewpoints regarding use of soft tissue lasers may be technique and/or indication related. Laser treatment involves soft tissue alone. Yet, for some of these procedures to be done without future consequences or even failure, bone must be removed to allow development of the biologic width and preservation of a healthy periodontium. Five of the 8 clinical procedures investigated involved possible violation of biologic width. The biologic width is the vertical distance established by the connective tissue attachment and junctional epithelial attachment to the root surface of a

tooth. If the biologic width is violated by surgical removal of gingival tissues, these tissues will rebound negating the procedure altogether, or chronic inflammation will result.[34] Even though the survey instructed respondents to assume the procedures were done correctly, and specified that this included no violation of biologic width, the biggest differences of opinion between orthodontists and periodontists were seen in these procedures. Although a majority of periodontists (59%) indicated approval of soft tissue laser use by orthodontists, perhaps this approval was contingent upon the laser procedure not involving the possibility of violating the biologic width. However, the study did not address specifically why certain practitioners expressed that laser use by orthodontists to perform various procedures was inappropriate.

The prevalence of laser use among the 3 groups surveyed was not significantly different. The advances in laser technology have made it possible to use lasers to perform gingival procedures that were traditionally achieved using a scalpel blade. Although there is questionable advantage of lasers over scalpels with regard to tissue healing,[35] several advantages of laser use have been cited in the literature. Some of these advantages were summarized by Rossman and Cobb[36] and included: ease of use, more precise cutting, cleaner surgical field due to laser's ability to cauterize blood vessels, sterile surgical field resulting in less post-operative infection, less scaring, and less damage to adjacent tissues. Perhaps orthodontists and general dentists find that laser use for minor gingival surgeries has made this service more convenient and affordable for their patients by avoiding the referral of these procedures to other dental specialists. Although this was not addressed directly by this study and there are no data to compare current laser use to

historical use, it is likely that laser use among dental practitioners, both surgeons and non-surgeons, is on the rise.

In a recent study published by Lanning et al,[37] the authors reported that a majority of Virginia general dentists surveyed did not perform surgical periodontal procedures. They also concluded that the surgical procedures most commonly performed were crown lengthening and pocket reduction surgery, which were done by 48% and 24% of general dentists, respectively. Although these procedures can be performed with a soft tissue laser, the study by Lanning et al[37] did not distinguish between scalpel and laser surgery so the prevalence of soft tissue laser use among general dentists in that study could not be determined. In the present study, 27% of general dentists said they used a soft tissue laser and 5 out of 8 of the laser procedures included in this survey were reported to be performed by a majority of the general dentists who use a laser.

Proportionately, respondent orthodontists were more likely to be male, to be older, and to have graduated earlier than the periodontists and general dentists surveyed. However, none of the significant differences in responses regarding soft tissue laser use among the 3 groups in this study were attributable to differences in gender, age, or year of graduation.

It was not surprising that a large majority (85%) of the survey respondents were male. Although the relative proportion of female dentists in the United States has increased from less than 3% in 1970 to greater than 14% in 2002,[38] a great majority of dental practitioners are male and were, therefore, much more likely to respond to the survey. Gender had no effect on soft tissue laser use among the 3 groups surveyed in this

study. This finding was similar to that of a study completed by del Aguila et al[39] in which Washington state general dentists were surveyed and there were no differences in the types of dental procedures reported to be performed between male and female practitioners.

Laser use among orthodontists is relatively new. Therefore, it was perhaps surprising that there were no differences in age or year of graduation for laser use found in this study. In contrast, age differences among dental practitioners who perform certain procedures have been reported previously in the dental literature. For example, Lanning et al[37] reported a significant effect of age on general dentists' practice behavior, with younger, more recent graduates more likely to perform certain surgical procedures including placement of dental implants. Potter et al,[40] however, found the opposite to be true in a survey of endodontists with older endodontists more likely to report placing implants. In both studies, authors attributed the trend found to whether or not the procedure was being taught as part of a residency program. Experience placing implants during a residency lead to more implant placement by young graduates. No experience during residency training lead to less placement. However, the actual reason for the effect of age, or lack thereof, on the type of procedures performed by dental practitioners is not known. As laser technology continues to improve and perhaps becomes more commonly incorporated into the formal instruction and training provided in dental schools and residency programs, the use of lasers among new practitioners will likely increase. If that occurs, age could emerge as a stronger predictor of laser use, with younger, more recent graduates being more likely to use soft tissue lasers.

A visual analog scale (VAS) was used to quantify the perception of appropriateness of 8 specific soft tissue laser procedures performed by orthodontists. These procedures had been previously reported in review articles and case reports found in the orthodontic literature.[1,18-21] The higher the score assigned by survey participants to a particular procedure, the more appropriate the respondents perceived the use of a soft tissue laser by orthodontists. All 3 groups agreed that the most appropriate soft tissue laser procedure performed by an orthodontist was "uncovering temporary anchorage devices." However, the groups did not agree on the procedures deemed least appropriate which were reported to be "frenectomy," "removal of keratinized gingiva to expose unerupted teeth," and "ablation of aphthous ulcers" by orthodontists, periodontists, and general dentists, respectively. For all 8 procedures investigated, periodontists were significantly more likely to indicate lower levels of appropriateness than the other 2 groups ($P < 0.001$). Orthodontists were significantly more likely than the other 2 groups to indicate higher levels of appropriateness for "gingivectomy to enhance esthetics" and "operculectomy" ($P < 0.001$).

Personal use of a soft tissue laser significantly affected the perception of orthodontists and periodontists, but not general dentists, regarding the appropriateness of soft tissue laser use by orthodontists. Nearly three-quarters of orthodontists who believed it was appropriate for orthodontists to use a soft tissue laser also used a laser themselves. For periodontists, there was nearly equal likelihood of reporting that use of a soft tissue laser by orthodontists was appropriate as inappropriate if the periodontist did not personally use a soft tissue laser. But, for periodontists who did use a laser in their

practice, they were more than 3 times as likely to say it was appropriate for orthodontists to use a soft tissue laser also. This trend suggests that perhaps those practitioners who use a laser have a better understanding of this technology than those who don't use lasers and therefore feel it more appropriate that orthodontists use lasers as well.

A large majority (78%) of all practitioners surveyed believed laser use by an orthodontist would have no effect on referrals to the orthodontist's practice. However, there were differences among groups. General dentists were equally likely to think that referrals would either increase or decrease (about 13% each). Orthodontists were more likely to think that laser use would increase, rather than decrease referrals to their practice (11% and 7%, respectively). These orthodontists likely think that laser use will portray a positive image to their patients and referring dentists by showing that they have the latest technology. Also, the added service provided may be viewed as a practice builder. However, periodontists were less likely to think that referrals would increase and more likely to think that referrals would decrease (10% and 21%, respectively) for orthodontists who use a soft tissue laser. It could be that periodontists are more likely to believe that referrals to an orthodontist who uses a soft tissue laser would decrease because periodontists themselves would not refer to an orthodontist who performs periodontal surgery with a laser. However, it is not likely that a significant number of orthodontic referrals come from periodontists so this perception may have limited significance for orthodontists. Another possibility is that some periodontists may perceive the possibility that negative sequelae resulting from laser procedures done incorrectly by an inexperienced practitioner could negatively affect practice referrals.

All laser procedures considered in this investigation were offered to some extent by orthodontists, periodontists, and general dentists, but these groups of practitioners were not equal in their likelihood to perform these procedures. Among the 3 groups of practitioners, only 2 out of the 8 laser procedures investigated showed no difference in the percentage of positive responses when respondents were asked which procedures they performed. These 2 procedures were "gingivectomy to enhance esthetics" and "operculectomy." Of the other 6 soft tissue laser procedures, only "frenectomy" was done significantly less by orthodontists than the other 2 groups, while orthodontists performed the other procedures equal to or more than periodontists and general dentists. It is likely that these results indicate the perceived relative difficulty of the various procedures investigated. Perhaps the 3 groups perceive "gingivectomy to enhance esthetics" and "operculectomy" as relatively simple procedures, independent of experience or training with soft tissue lasers. Likewise, perhaps orthodontists perceive that "frenectomy" is a relatively difficult procedure to perform with a soft tissue laser and would rather refer patients needing a frenectomy to another dental specialist.

All methods of soft tissue laser training investigated in this study were utilized by each of the 3 groups of practitioners. The only significant difference among those who said that they use a soft tissue laser was the likelihood that their training was obtained in an advanced dental program or residency program. Fifty-six percent of periodontists who use a laser said that they were trained to do so formally, while only 10% of orthodontists and 14% of general dentists had exposure to formal laser training. Of interest to note is that periodontists had significantly more continuing education credit hours earned related

to soft tissue lasers even though proportionately general dentists had a slightly larger percentage trained in this manner (71% compared to 61% and 54% for orthodontists and periodontists, respectively). The remaining were trained by sales staff instruction, company-sponsored certification courses, or were self-taught. As the use of soft tissue lasers increases among dental practitioners, it is likely that more formal training will become implemented in the curriculum of dental schools and residency programs.

This study had several limitations. Being based on the self-reported and subjective perceptions of the respondents, the results are subject to the inherent personal biases of each respondent. That is, those that responded to the survey were more likely to be performing the procedures investigated and more interested in this topic than those not using a laser, regardless of which group they originated from. Furthermore, some of the reported data, such as the amount of continuing education credits and the reported frequency of laser use require those surveyed to recall past events, which may or may not be accurate. The aim of the study was to compare the perceptions of orthodontists, periodontists, and general dentists regarding the use of soft tissue lasers by orthodontists. Although statistical analysis determined significant differences in perceptions among the three groups, no conclusions can be drawn regarding the effectiveness of the treatments performed with a soft tissue laser.

The overall return rate (18%) was unexpectedly low compared to other survey studies administered similarly.[41-46] All attempts were made in this study to ensure a high return rate. A cover letter was used to emphasize the purpose of the study and to convey the confidentiality of the answers submitted. The survey was brief and those who

voluntarily pre-tested the survey indicated that it took no longer than 5 minutes to complete. A self-addressed, pre-paid envelope was included for respondents to return their answers. Finally, the survey was sent out in a follow-up mailing to those who did not respond to the initial mailing. Although the return rate of the orthodontists was slightly lower than expected at 34% (N=330), it was acceptable. However, the low return rates of 13% (N=131) for periodontists and 8% (N=77) for general dentists made it difficult to draw definitive conclusions from the results obtained. Due to the controversial nature of the issue, the overlap in services provided by orthodontists with those provided by individuals in the other survey groups who use a soft tissue laser, and the novelty of the treatment modality, the survey was expected to inspire interest from all 3 groups. Perhaps the issue has received more attention in orthodontics than in periodontics or general dentistry. The return rate of the orthodontists was nearly 3 times that of the periodontists and over 4 times that of the general dentists. It is possible that orthodontists were more motivated to participate because the survey was labeled as originating from an accredited United States graduate orthodontic program. This may have also decreased the interest of periodontists and general dentists. Perhaps the return rate of these 2 groups could have been improved if the surveys had been sent exclusively to local practitioners instead of distributing the surveys nationally. Maybe then the surveys would have been received with more interest due to a desire to provide information perceived to be of local importance.

Conclusions

In general, when compared to orthodontists and general dentists, a lower percentage of periodontists indicated that soft tissue laser use by orthodontists was appropriate ($P = 0.001$). Also, for each of the 8 specific soft tissue laser procedures investigated, periodontists reported a significantly lower level ($P = 0.001$) of appropriateness than did orthodontists and general dentists. None of the observed differences were related to differences in gender, age, or year of graduation. There was no significant difference among the groups in prevalence of laser use with 28% of all respondents reporting current laser use. For orthodontists ($P = 0.001$) and periodontists ($P = 0.0076$), there was a significant relationship between personal laser use and perceived appropriateness of laser use by orthodontists with those practitioners who use a soft tissue laser being more likely to report a more positive perception of appropriateness. A large majority of all respondents believed that laser use by orthodontists would have no effect on referrals to the orthodontist. However, there were differences among the practitioner groups with general dentists equally likely to think that referrals would increase as decrease, orthodontists more likely to believe that referrals would increase ($P = 0.0026$), and periodontists more likely to believe that referrals would decrease ($P = 0.001$). Orthodontists were less likely to perform "frenectomies" than periodontists and general dentists ($P = 0.001$). Of those who currently use a laser, periodontists were much more likely to have been trained to use a laser in a formal education setting ($P < 0.001$) and to have earned more soft tissue laser-related CE credit hours over the past 5 years ($P = 0.0006$). Regardless of which practitioner uses a soft tissue laser, orthodontists,

periodontists, and general dentists need to communicate effectively to ensure that the orthodontic patient in need of adjunctive soft tissue surgery is treated to the accepted standard of care. Further well-designed studies are needed to determine the effectiveness of soft tissue laser treatments intended to aid in the efficiency of orthodontic treatment.

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Appendix A (Survey)

Gender: [ ] Male [ ] Female

2. **Age** _____

3. **Are you an orthodontist?** [ ] Yes [ ] No
(*if no, what is your specialty?)*_____

4. **Year of graduation from specialty program** _____

5. **Do you feel it is appropriate for a soft tissue laser to be used by an orthodontist?**
[ ] Yes [ ] No

6. **Please place a vertical mark on the scale to indicate how appropriate you feel it is for an orthodontist to perform the following using a soft tissue laser.** ***(Assume the procedures are done correctly, ie. no violation of the biologic width)***

A) Gingivectomy to improve/facilitate hygiene around brackets/bands

inappropriate |_____| appropriate

B) Gingivectomy to enhance esthetics by improving gingival symmetry or tooth size proportions

inappropriate |_____| appropriate

C) Operculectomy

inappropriate |_____| appropriate

D) Uncovering Temporary Anchorage Devices due to overgrowth of mobile mucosa

inappropriate |_____| appropriate

E) Removal of keratinized gingiva for proper bracket positioning on incompletely erupted teeth

inappropriate |_____| appropriate

F) Removal of keratinized gingiva to expose unerupted teeth

inappropriate |_____| appropriate

G) Frenectomy

inappropriate |_____| appropriate

H) Ablation of aphthous ulcers

inappropriate |_____| appropriate

7. **The use of a soft tissue laser by an <u>orthodontist</u>…**
[ ] Increases referrals to the orthodontist's practice
[ ] Decreases referrals to the orthodontist's practice
[ ] Has no effect on referrals to the orthodontist's practice

8. **Do you currently use a soft tissue laser in your practice?** [ ] Yes [ ] No
(if you answered *no*, you are finished with the survey; if you answered *yes*, please continue)

9. **Which of the following procedures, adjunctive to orthodontic treatment, do you perform with a soft tissue laser?** (check all that apply*)*
[ ] Gingivectomy to improve/facilitate hygiene around brackets/bands
[ ] Gingivectomy to enhance esthetics by improving gingival symmetry or tooth size proportions
[ ] Operculectomy
[ ] Uncovering Temporary Anchorage Devices due to overgrowth of mobile mucosa
[ ] Removal of keratinized gingiva for proper bracket positioning on incompletely erupted teeth
[ ] Removal of keratinized gingiva to expose unerupted teeth
[ ] Frenectomy
[ ] Ablation of aphthous ulcers
[ ] Other: _____

10. **What kind of training enabled you to incorporate the soft tissue laser into your practice?** (check all that apply)
[ ] Formal Advanced Dental Program or Dental Specialty/Residency Program
[ ] Official continuing education credit
[ ] Self-taught
[ ] Instruction by sales staff
[ ] Company-sponsored certification course
[ ] Other: _____

11. **How many hours of official continuing education credit relating to soft tissue lasers have you earned within the last 5 years?**
[ ] 0 hours [ ] 1-8 hours [ ] 9-16 hours [ ] 17-24 hours [ ] > 24 hours

12. **How often do you use your soft tissue laser?**
[ ] daily
[ ] weekly
[ ] monthly
[ ] less than once a month

13. **Do you charge your patients a fee for soft tissue laser procedures adjunctive to orthodontics?**
[ ] yes [ ] no [ ] sometimes

14. **What are the advantages of using a soft tissue laser in your practice?** (check all that apply)
[ ] Esthetic enhancement of cases
[ ] Improves efficiency of orthodontic treatment
[ ] Ensures that the procedure gets done
[ ] Saves my patients money
[ ] Facilitates marketing of my practice
[ ] Other: _____

Comments:

Appendix B (Comments)

Orthodontists

"all questionnaires should be this concise"

"We are currently looking into incorporating lasers into our practice"

"orthodontists- I am afraid- maybe use lasers too often when apically positioned flaps should be done. In my opinion this is related to the cavalier way lecturers present their material. They do not {} periodontal concerns."

"I would consider buying/using laser if (when) practice would slow. Am sufficiently busy and refer surgery, TADS, laser, etc"

"leave it for perio/oral surgery"

"I choose not to use laser at this time, but may in the future"

"One of the best things I have ever added to my practice. I do recommend certification by the ALD. I hope you are taught this in school as well."

"6H. Don't know; high risk procedure- skill level needs to be the level of a periodontist to avoid lawsuit"

"#7 difficult to answer- depends on 1. which procedure? 2. does the GP also do this procedure in office- if so, probably better to refer back to GP"

"I don't use a soft tissue laser"

"As long as the orthodontist is adequately trained and can prove it to me- and most importantly, demonstrate proficiency, I would have no problem with them doing any procedure, I have had success using a scalpel, but a laser would certainly make it easier"

"What a crock! Why hurt your GPs, perios, and OMS that you work with and who refer to you?"

"Laser tissue healing after surgery is excellent- much better than scalpel. It is enjoyable to see results."

"I have had a soft tissue diode laser for over 5 years!"

"5. but limited"

"5. but limited"

"saves the patient from going to the periodontist or oral surgeon esp for uncovering impacted cuspids"

"an absolute benefit to my patients and my practice"

"5. if he/she wants to"

"I have never had a poor result or any patient that was unhappy with the result"

"I feel it requires so much additional training and supplies- not worth the effort- I send them to my periodontist!"

"5. if trained"

"I plan on purchasing a laser very soon and taking a course"

"I currently don't have a laser I don't feel I have enough training."

I would love a copy of your findings for my webinars <Name Deleted>@aol.com

"I have done this over four years and I feel that gum recontouring procedures enhance the orthodontic outcome in many ways. It is essential that I can achieve the same outcome that a periodontist can obtain to do this process."

"#8: But may soon!"

"Soft tissue lasers are a great invention. Orthodontics is the specialty devoted to moving teeth. Periodontists do not bond ortho attachments to help hold their perio dressings and so orthodontists should not surgically contour the periodontium, unless the specialist is dual degree in orthodontics and periodontics. Just one conservative orthodontist's opinion."

"#8: Just bought one, plan on. #12: NA - Soon though, probably 1-2x's/week"

"#7: Can't answer"

"But have thought about getting one!"

"Planning on incorporating laser in practice 2010"

"It's all about what you are comfortable with and communication with the patient and restorative dentist."

"I bill insurance for frenectomies, not for tooth exposure."

"I do not have a laser at this time but I am planning to purchase one"

"Questionable legality due to state dental practice act and specialties"

"#8: Too expensive"

"We are teaching residents in the Advanced Education program in orthodontics about the selective used of lasers; however we still communicate with and refer to periodontists as appropriate"

"My husband does these for me in his practice, however I would given time."

"#8: I plan to purchase one in 2010."

"I don't have a laser but am in the process of getting one."

"Are we specialists in orthodontics or a "jack of all trades"? Where has exclusivity of practice gone to? Do not complain of general dentist and others doing ortho if you are performing general dental, perio, or other procedures. Some people are motivated more by money than exceptional level of care provided by each specialty, ie periodontist. #7: Unsure"

"I use electrosurgery unit and can achieve successful results similar to a soft tissue laser at less cost. But I'm conservative with my approach and limit my use of electrosurgery to what I feel comfortable with doing."

"Do not use laser but plan to."

"#7: Not professional. #9: None! Perio & GP & OS only qualified. Comments: This is what's wrong with orthodontists. Lone ranger cowboys - and I'm an orthodontist! Gives us a bad name & turf issues."

"Recently purchased one but have not yet used it"

"I use local anesthesia and a high speed with a new finishing bur to accomplish everything that a laser can do except frenectomies and ulcers. Routinely. Who needs to pay for a laser???"

"No advantage. I'm busy moving teeth – my primary directive!"

"Pt/parent acceptance of laser treatment in my office has been fantastic. It paid for itself within the first year."

"I can't imagine practicing orthodontics without a laser!"

"Third party payment may be a problem. Acceptance by general dentists and periodontists may also be a negative."

"Marginally facilitates markting of my practice"

"I believe that laser surgery should be an integral part of an orthodontic curriculum for all the reasons in question #4. Treatment effeciency is greatly facilitated."

Periodontists

"money maker for practice. Does not enhance anything else if that."

"orthodontists have no surgical training most do not even give local anesthesia. They have no training in dealing with surgical complications i.e. infection, bleeding, tissue necrosis- even post surgical pain management - all these complications will negatively impact the practice of the orthodontist"

"Re: questions #6- It is impossible for me to assume that the procedure such as gingivectomy will be done correctly without the proper training and knowledge of things such as biologic width. Is the orthodontist going to probe the tissue to ensure that? When does an orthodontist take out a perio probe??"

"5. why not everyone else is in on the act"

"research lacking in randomized controlled clinical studies"

"9. correction of altered active eruption w/ a Brolase hard and soft tissue laser; leave the perio therapy in the hands of those who have years of training in perio!"

"It's proper for orthodontists to do any soft tissue procedure that will enhance the result without extra referrals just know enough not to get into trouble bc fee is not enough to justify post-op complications"

"One needs to understand biologic width, the attachment apparatus, and other biologic principles to accurately address periodontal conditions. One also needs to diagnose the problem accurately in order to render appropriate tretment."

"my experience with lasers is that they are inadequate to really produce great long term results in [unable to read handwriting at end of sentence]. Oh, they are also very slow."

"I have "fixed" several laser cases done by orthodontists when poor outcomes were obtained (because they were trying to do hard and soft tissue modifications and it didn't work (or look right to patient) I hope orthodontists get the proper training!! Also- they should charge an appropriate fee and not devalue laser service by 'giving it away.'"

"Orthodontists are too interested in marketing & money & not in best treatment for their patients. #5: Absolutely not."

"Appropriately, any trained clinician should be able to use this instrument"

"With any use of a laser I am concerned about preservaton of the biologic width as it can't be visually guaranteed."

"Ortho need better training on laser physics and biologic width befoe doing some procedures."

"Orthodontists are not periodontists! They do not know anything about periodontal tissues and can do more harm than good if they perform periodontal procedures."

"#5: Only if he knows what he is doing. #6b: Cannot be done appropriately"

"I use the laser to treat I.P.D. I work with several orthodontists and do adjunctive procedures for them, but I surely use the laser. I believe B, E, and F are potentially difficult procedures, often requiring the judicious removal of bone. Lasers don't help you here (soft tissue lasers). Then on procedures which require good judgment and understanding."

"Many procedures can be done with topical anesthesia only so childrens' fear of needles can be eliminated."

"The bottom line is: How able the person is with accomplishing aesthetic procedures at the same level as the standard of care. #5: Depends on their abilities."

"Lots of sales hype. Best use around dental implants, otherwise scalpel or electrosurgery is much better."

"#6B: May need bone recontoured & can't be addressed with soft tissue laser. #6E: Tissue may need to be apically repositioned not lased away. #6F: Most often needs bone removed & not addressed by soft tissue laser. #6G: Does not remove fibers into suture or between 8 & 9 and will lead to relapse. #8: Trained with CO2 & Nd:YAG"

"Lasers are expensive devices that cut tissue. Much hype - poor science. I have observed recent ortho grads are being taught surgery - is this part of ortho now?"

"There are no significant advantages of a laser over a blade."

"Specialties should retain their character"

"Use ST laser for impant uncoverings and frenectomy most often. Crown lengthenings are mostly with electrosurg."

"The use of a soft tissue laser by an orthodontist decreases referrals to the periodontist."

"GV needs to be considered in conjunction with perio status - sufficient & even amount of AG around all teeth, no MG issues. In many ortho cases AG has to be grafted after too enthusiastic GV during ortho"

"Laser fee = blade fee"

"#7: Depends on how they choose to market themselves"

General Dentists

"I also do orthodontic treatment :)"

"5. especially if general dentist doesn't presently have one."

"Orthodontics is not a surgical specialty. A practice restricted to orthodontics should not be doing surgery of any kind. The same is true for periodontists who should not be doing prosthetics."

"I have no objection if orthod. Is properly trained."

"7. by whom? Pt or other dentists?; lasers are a wonderful addition to modern dentitry"

"I do not do ortho"

"If I had a laser, I would probably prefer that the orthodontist allow me to do the treatment"
"#8: Electrosurge"

"I am a firm believer that general DDS should not do ortho and that ortho should not do general DDS treatment. A mutual referral of treatment maintains better relationships and trust between the two! Thank you #12: Daily - soft tissue & prep of teeth"

"Currrently in process of buying one."

"Orthodontist probably not as qualified to use laser as GP or periodontist"

Vita

Dr. Brandon G. Burke was born in Price, Utah on March 31, 1979. He was raised in Utah and also lived in Brazil for 2 years following graduation from high school. He attended the College of Eastern Utah and Dixie State College on basketball scholarship prior to graduating with a Bachelor of Science degree from Utah State University in 2004. He attended dental school at the University of North Carolina where he graduated with High Honors and Distinction in 2008. He was granted admission to the graduate orthodontic program at the Virginia Commonwealth University Department of Orthodontics in 2008 and received a Certificate in Orthodontics as well as a Master of Science in Dentistry degree in 2010. Dr. Brandon G. Burke will enter the private practice of orthodontics in Saint George, Utah.