Original Article

Perceptions of soft tissue laser use in orthodontics
A survey of orthodontists, periodontists, and general dentists

Brandon Burke[a]; Ahmad Mohammad Hamdan[b]; Eser Tufekci[c]; Bhavna Shroff[d]; Al M. Best[e]; Steven J. Lindauer[f]

ABSTRACT

Objectives: To compare attitudes of orthodontists, periodontists, and general dentists regarding the use of soft tissue lasers by orthodontists during the course of orthodontic treatment.

Materials and Methods: An analogous survey was developed to evaluate and compare the current opinions of a representative sample (n = 538) of orthodontists (61.3%), periodontists (24.3%), and general dentists (14.3%) regarding orthodontists' use of soft tissue lasers.

Results: The majority (84%) of orthodontists, periodontists, and general dentists regarded the use of a soft tissue laser by orthodontists as appropriate. When compared to orthodontists and general dentists, a lower percentage of periodontists indicated that soft tissue laser use by orthodontists was appropriate ($P < .01$). For each of the eight specific soft tissue laser procedures investigated, periodontists reported a significantly lower level of appropriateness than did orthodontists and general dentists ($P < .01$). Around 75% of the total sample believed that referral would not be affected by the use of soft tissue lasers by orthodontists.

Conclusions: Orthodontists, periodontists, and general dentists differed in their opinions of the perceived appropriateness of soft tissue laser use by orthodontists, with periodontists reporting a lower level of appropriateness. Clinicians need to communicate effectively to ensure that orthodontic patients in need of adjunctive soft tissue surgery are treated to the accepted standard of care. (*Angle Orthod.* 2012;82:75–83.)

KEY WORDS: Orthodontics; Laser

INTRODUCTION

Lasers have been used in dentistry since the 1960s. Researchers and clinicians have explored the possibilities of replacing conventional treatment techniques with lasers in the hope of improving patient care. Early publications focused on the treatment of dental caries,[1,2] but the decades that followed brought increased attention to treatment of oral soft tissues.[3–7]

More recently, the diode laser has been used in orthodontic practice, and published reports demonstrate its usefulness for addressing esthetic and other soft tissue challenges facing orthodontists.[3–7] Hilgers and Tracey[4] illustrated 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. Sarver[6] found that the diode laser offered good hemostasis, reduced the potential for infection, and prevented damage to teeth and bone as a result of its affinity for soft tissue only. Sarver and Yanosky[3] found that the use of a diode

[a] MS student, Department of Orthodontics, School of Dentistry, Virginia Commonwealth University, Richmond, Va.

[b] Associate Professor, Department of Orthodontic & Pediatric Dentistry, Faculty of Dentistry, University of Jordan, Amman 11942 Jordan.

[c] Associate Professor, Department of Orthodontics, School of Dentistry, Virginia Commonwealth University, Richmond, Va.

[d] Professor and Graduate Program Director, Department of Orthodontics, School of Dentistry, Virginia Commonwealth University, Richmond, Va.

[e] Associate Professor, Department of Biostatistics, School of Dentistry, Virginia Commonwealth University, Richmond, Va.

[f] Professor and Chair, Department of Orthodontics, School of Dentistry, Virginia Commonwealth University, Richmond, Va.

Corresponding author: Dr Ahmad Mohammad Hamdan, Department of Orthodontics, School of Dentistry, Virginia Commonwealth University, 520 North 12th Street, Richmond, VA 23298
(e-mail: amhamdan@vcu.edu)

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Table 1 The Survey

1. **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 <u>vertical mark</u> 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

Table 1. Continued

(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

Comments:

laser in their orthodontic practice resulted in improved esthetics in their cases and increased the efficiency of treatment.

The diode laser can be 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 tissues to uncover temporary anchorage devices, and for the treatment of aphthous ulcers or herpetic lesions.[3–7] 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 reporting 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 study was to investigate the perceptions of orthodontists, periodontists, and general dentists toward the use of soft tissue lasers by orthodontists during the course of orthodontic treatment.

MATERIALS AND METHODS

The Virginia Commonwealth University granted institutional review board approval to conduct the study.

Sample Selection

The American Association of Orthodontists (AAO), the American Academy of Periodontology (AAP), and

the American Dental Association (ADA) all granted permission to conduct the study. They each provided the names and addresses of 1000 randomly selected and actively practicing clinicians (for a total of 3000). All 50 US states were represented in each of the three groups in the sample.

Surveys were sent by mail and included an addressed, postage-paid envelope. Envelopes were numerically coded to identify nonrespondents. A follow-up survey was sent to those who did not return the questionnaire.

Analogous surveys were designed to gather information about the attitudes of orthodontists, periodontists, and general dentists toward the use of soft tissue lasers by orthodontists during the course of orthodontic treatment (Table 1). Prior to the study proper, the survey design was tested for ease of use by surveying and consulting full- and part-time faculty members at the Department of Orthodontics, Periodontics and General Practice at Virginia Commonwealth University.

The front page of each survey contained the title of the study and explained its purpose. At the beginning of the survey respondents were asked whether they were an orthodontist, periodontist, or general dentist in order to allow group comparisons of the results. The first section of the survey gathered demographic information, such as gender, age, and the calendar year of graduation from dental school. Respondents were then asked if they felt that it was appropriate for a soft tissue laser to be used by an orthodontist (Table 1).

The second section included eight questions on how appropriate respondents felt it was for an orthodontist to perform various soft tissue laser procedures reported in the orthodontic literature.[3–7] Respondents were asked to make a vertical mark on a 100-mm visual analog scale (VAS) labeled at one end with the word ''inappropriate'' and at the other end with ''appropriate.'' The higher the score the more appropriate the respondent felt the procedure was (Table 1).

Subjects were then asked how they thought the use of soft tissue lasers by orthodontists would affect referrals and whether or not they had used soft tissue lasers in their respective practices. If the answer to the latter question was ''yes,'' subjects were prompted to continue to the final section of the survey.

The final section was for those actively using a soft tissue laser and included questions about the procedures performed, the type and amount of training received, the frequency of use, and whether fees were charged for these services. A section allowing additional comments was also included at the end of the survey.

Table 2. Demographics of Surveyed Respondents[a]

	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

[a] SD indicates standard deviation.

Statistical Analyses

Data were entered into an Excel spreadsheet (Microsoft, Redmond, Wash), and the three groups were compared using a chi-square test or analysis of variance, as indicated by the outcome variable, with significance set at $P < .05$. All analyses were performed using SAS software (JMP version 8.0.2, SAS Institute Inc, Cary, NC).

RESULTS

Of the 3000 addresses provided by the AAO, AAP, and ADA, respectively, the addresses of 30 orthodontists, 17 periodontists, and 13 general dentists were not recognized by the post office as deliverable addresses. Surveys were therefore mailed to a total of 2940 clinicians: 970 orthodontists, 983 periodontists, and 987 general dentists.

A total of 538 surveys were returned; 61% of respondents were orthodontists, 24% were periodontists, and 14% were general dentists. The demographic characteristics of the respondents are described in Table 2. Overall, there was a greater proportion of male respondents ($P < .01$) and orthodontists were older and graduated earlier than did the other two groups of clinicians ($P < .001$; Table 2).

Perceived Appropriateness of Soft Tissue Laser Use

Eighty-four percent of the total sample felt that it was appropriate for an orthodontist to use a soft tissue laser in their practice. On an individual group basis, 93% of orthodontists, 88% of general dentists, and 59% of periodontists regarded soft tissue laser use by orthodontists as appropriate. Significantly fewer periodontists regarded soft tissue laser use as appropriate, compared to orthodontists and general dentists ($P < .001$).

Table 3 illustrates the responses of the clinicians with regard to the appropriateness of soft tissue laser use by orthodontists for eight specific proce-

Table 3. Perceived Appropriateness of Soft Tissue Laser Use by Orthodontists for Eight Specific Procedures[a]

	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 gingival 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 gingival 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

[a] VAS indicates visual analog scale; CI, confidence interval.

* Statistically significant difference compared to orthodontists and general dentists; $P < .001$; ** Statistically significant difference compared to periodontists and general dentists; $P < .001$.

dures. A higher mean VAS score indicates that the procedure was more appropriate for use. ''Uncovering TADs'' was given the highest mean VAS score by all three groups of clinicians (Table 3). The second highest VAS score recorded by orthodontists and periodontists was for ''gingivectomy to improve hygiene around brackets,'' whereas ''removal of keratinized gingival to expose unerupted teeth'' was scored second by general dentists (Table 3). Both orthodontists and general dentists allocated mean VAS scores greater than 50 for all eight procedures, whereas mean periodontist scores were all below 50, with the exception of the ''uncovering TADs'' score (Table 3).

Further statistical analyses of the data showed significant differences among the three groups of clinicians for each of the eight soft tissue laser procedures ($P < .001$; Table 3). Periodontists recorded lower scores than both orthodontists and general dentists for all eight procedures ($P < .001$). Orthodontists allocated higher scores for ''gingivectomy to enhance esthetics'' and ''operculectomy'' compared to periodontists and general dentists, respectively ($P < .001$). None of the differences found in responses could be attributed to gender ($P = .56$), differences in age ($P = .61$), or year of graduation ($P = .98$).

Effect of Soft Tissue Laser Use on Referral Patterns

Figure 1 illustrates the perceived effect of soft tissue laser use by an orthodontist on referrals to their practice. Seventy-eight percent of the total sample

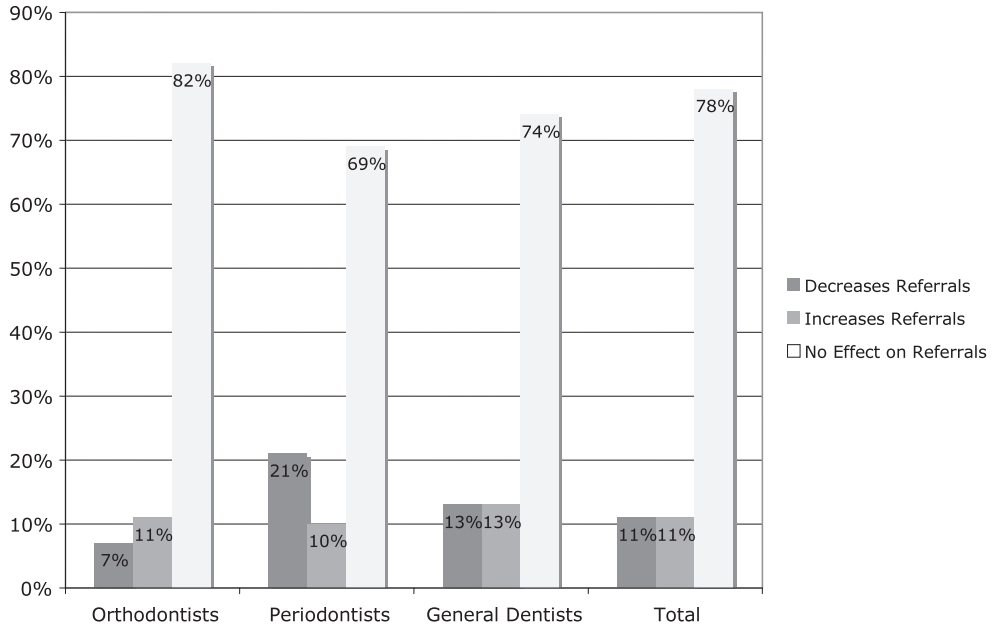

Figure 1. Perceived effect on referrals to orthodontists who use a soft tissue laser.

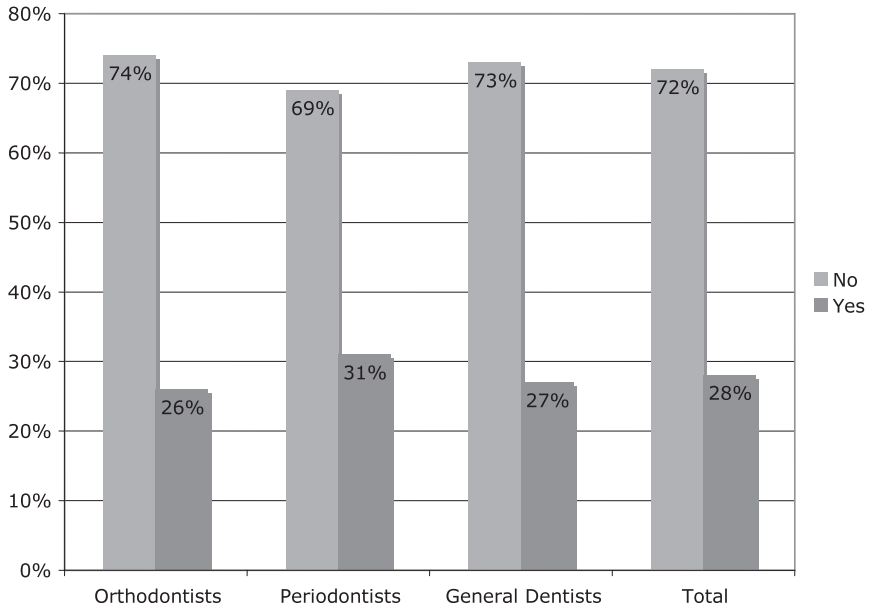

Figure 2. Prevalence of soft tissue laser use among survey respondents.

believed that there would be no effect on referrals, while the rest of the sample was split equally between an expectation of an increase and a decrease in referrals (Figure 1). Similarly, on an individual group basis the majority of clinicians thought that referrals would not be affected (Figure 1). Significantly more orthodontists perceived an increase rather than a decrease in referrals (11% and 7%, respectively; $P < .01$). Conversely, significantly more periodontists perceived a decrease rather than an increase in referrals (21% and 10%, respectively; $P < .01$). Equal proportions of general dentists felt that referrals would increase or decrease as a result of soft tissue laser use (13%, respectively; $P > .05$).

Use of Soft Tissue Laser by Respondents

The prevalence of laser use within the three practitioner groups is shown in Figure 2. 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 ($P > .05$).

Further analysis of the data was carried out to assess whether respondents' personal use of soft tissue lasers affected perceived appropriateness of use by orthodontists. Results showed that 71% of orthodontists who used a soft tissue laser regarded its use as appropriate, whereas all of the orthodontists who did not use a soft tissue laser regarded its use as inappropriate ($P < .05$). Similarly, 76% of periodontists that used a laser regarded its use as appropriate by orthodontists (Figure 3; $P < .05$). However, periodontists that did not use a laser were equally divided in their opinion as to the appropriateness of its use by orthodontists (Figure 3). Personal use of soft tissue lasers did not seem to influence general dentists' decisions regarding the appropriateness of its use by orthodontists ($P > .05$).

Procedures Performed with a Soft Tissue Laser

Table 4 illustrates the percentage of respondents performing adjunctive orthodontic procedures using a soft tissue laser. The most common procedures performed by orthodontists were "removal of keratinized gingiva to expose unerupted teeth" and to allow "proper bracket positioning" and "gingivectomy to

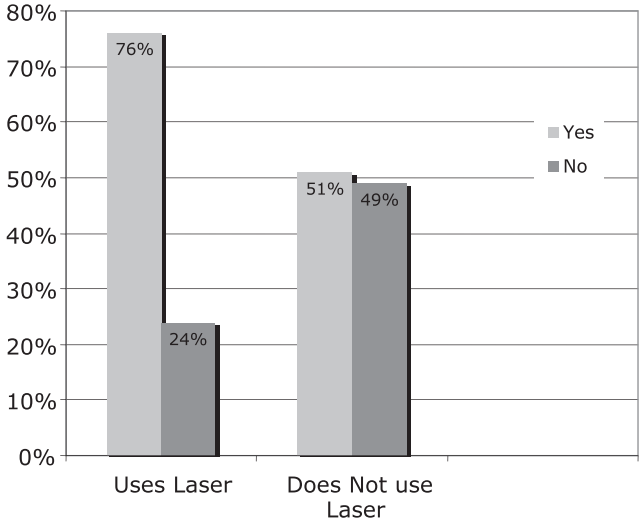

Figure 3. Relationship between periodontists' use of soft tissue lasers and perceived appropriateness of soft tissue laser use by orthodontists.

Table 4. Percentage of Respondents Performing Adjunctive Orthodontic Procedures Using a Soft Tissue Laser

	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 gingival for proper bracket positioning	90*	61	43
Removal of keratinized gingival to expose unerupted teeth	91*	54	43
Frenectomy	39*	88	67
Ablation of aphthous ulcers	45	44	67

* $P < .01$.

improve hygiene.'' The most common procedures performed by periodontists were ''frenectomy'' and ''gingivectomy to enhance esthetics.'' A similar percentage of general dentists carried out a wide range of procedures, including gingivectomy to ''improve hygiene'' and ''enhance esthetics,'' ''operculectomy,'' ''frenectomy,'' and ''ablation of aphthous ulcers.'' Statistical analyses among groups are illustrated in Table 4.

Training

Table 5 shows the data for different types of soft tissue laser training reported by the practitioner groups. Periodontists were more likely than either general dentists or orthodontists to have been trained to use a soft tissue laser in a formal educational setting ($P < .001$). There was no difference among the three practitioner groups regarding training obtained from continuing education (CE) classes, self-taught training, training provided by sales staff, or company-sponsored training.

There was a significant difference among the three practitioner groups in the number of hours of soft tissue laser–related CE credits reportedly earned in the last 5 years, as shown in Table 6 ($P < .001$). Periodontists reported more CE credit hours, with 44% reporting more than 24 hours of CE and over 50% reporting at least 17 hours.

There was no significant difference among the three groups with regard to how often the soft tissue laser was used, with most practitioners using it weekly ($P > .05$). Ninety-five percent of periodontists and 80% of general dentists said they charge a fee (''yes'' or ''sometimes''), compared to only 52% of orthodontists ($P < .001$).

DISCUSSION

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 more than 14% in 2002,[8] the majority of dental practitioners are male and were, therefore, more likely to respond to the survey. Gender had no effect on soft tissue laser use among the three groups surveyed in this study. This finding was similar to that of a study completed by Del Aguila et al.[9] in which Washington State general dentists were surveyed, and there were no differences in the types of dental procedures performed between male and female practitioners.

Laser use among orthodontists is relatively new. It was therefore surprising that there were no differences in responses related to age or year of graduation in the present study. In contrast, Lanning et al.[10] reported a significant effect of age on general dentists' practice behavior, with younger, more recent graduates being more likely to perform certain surgical procedures, including placement of dental implants. Conversely, Potter et al.[11] found that older endodontists were more likely to report placing implants. As laser technology continues to improve and perhaps becomes more commonly incorporated into the formal instruction and training provided by dental schools and residency programs, the use of lasers among new practitioners is likely to increase.

Perceived Appropriateness of Soft Tissue Laser Use

The use of a soft tissue laser by orthodontists was considered appropriate by the majority (84%) of

Table 5. Forms of Soft Tissue Laser Training Acquired by Each Practitioner Group

Form of Training	Orthodontists, No. (%)	Periodontists, No. (%)	General Dentists, No. (%)
Formal advanced dental program or residency program	9 (10)	23 (56)	3 (14)
Continuing education	53 (61)	22 (54)	15 (71)
Self-taught	33 (38)	12 (29)	8 (38)
Instruction by sales staff	28 (32)	6 (15)	8 (38)
Company-sponsored certification course	44 (51)	23 (56)	8 (38)

Table 6. Soft Tissue Laser Continuing Education (CE) Credit Hours Earned in Last 5 Years

Credit Hours	Orthodontists, No. (%)	Periodontists, No. (%)	General Dentists, No. (%)	Total, No. (%)
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)

* $P < .001$.

respondents. However, periodontists' approval (59%) was significantly less than that of orthodontists (93%) and general dentists (88%), respectively ($P < .001$). Periodontists generate revenue by performing surgical and nonsurgical procedures aimed at improving the health and esthetics of the oral soft tissues. It could have been that the lower rate of approval by periodontists was a result of economic implications associated with orthodontists performing such procedures. Alternatively, some periodontists may have felt that the use soft tissue lasers should be limited to specialists trained in their use and better aware of the possible clinical and biological consequences.

The highest mean VAS score allocated by all three groups of clinicians was for "uncovering TADs" (Table 3). This finding was not surprising, since TADs are now commonly placed by orthodontists, and their maintenance and follow-up may be regarded as the responsibility of the orthodontist. There were fewer instances of consensus among groups on the appropriateness of the other seven soft tissue laser procedures. Five of the eight clinical procedures investigated involved possible violation of biologic width, which may result in rebound of the tissues, thus negating the procedure altogether or resulting in chronic inflammation.[12] Even though the survey instructed respondents to assume that the procedures were done correctly, and despite the fact that it specified that this included no violation of biologic width, the biggest differences of opinion between orthodontists and periodontists were seen in those procedures (Table 3).

Effect of Soft Tissue Laser Use on Referral Patterns

Over 75% of all practitioners surveyed believed laser use by an orthodontist would not affect referrals to the orthodontist's practice. However, there were differences among groups (Figure 1). More orthodontists felt that laser use would increase rather than decrease referrals to their practice (11% vs 7%, respectively). These orthodontists may have felt that laser use would portray a positive image to their patients and referring dentists by showing that they used the latest technology. Furthermore, this service may have been viewed as a practice builder. Conversely, periodontists felt that referrals were more likely to decrease than increase (21% and 10%, respectively). This may have been because periodontists themselves would be less likely to refer to an orthodontist who was performing periodontal surgery with a laser. The possibility of negative sequelae resulting from laser procedures carried out by an inexperienced practitioner may have further supported this view.

Use of Soft Tissue Laser by Respondents

The prevalence of laser use among the three groups surveyed was not significantly different (Figure 2). 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 the advantage of laser use over scalpels with regard to tissue healing is questionable,[13] several advantages were summarized by Rossman and Cobb.[14] These included ease of use, more precise cutting, cleaner surgical field as a result of the laser's ability to cauterize blood vessels, and a sterile surgical field, resulting in less postoperative infection, less scarring, and less damage to adjacent tissues.[14] Perhaps orthodontists and general dentists found that laser use for minor gingival surgeries made such services more convenient and affordable for their patients by avoiding referral to other dental specialists.

Procedures Performed with a Soft Tissue Laser

All laser procedures considered in this investigation were offered to some extent by orthodontists, periodontists, and general dentists (Table 4). The most common procedures performed by orthodontists were "removal of keratinized gingiva to expose unerupted teeth" and to allow "proper bracket positioning" and "gingivectomy to improve hygiene" (Table 4). These findings were not surprising, since the above-mentioned procedures are all closely related to the core of orthodontic treatment, and orthodontists could potentially carry out these procedures as part of their day-to-day practice.

The present study has 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. Hence, respondents were more likely to be performing the procedures investigated and more interested in this topic than those not using a laser, regardless of the group from which they originated. Furthermore, some of the reported data, such as the amount of CE credits and the reported frequency of laser use, required those surveyed to recall past events, which may or may not have been accurate.

CONCLUSIONS

- The majority (84%) of orthodontists, periodontists, and general dentists regarded the use of a soft tissue laser by orthodontists as appropriate.
- When compared to orthodontists and general dentists, a lower percentage of periodontists indicated that soft tissue laser use by orthodontists was appropriate ($P < .01$).
- For each of the eight specific soft tissue laser procedures potentially performed by orthodontists that were investigated, periodontists reported a significantly lower level of appropriateness than did orthodontists and general dentists ($P < .01$).
- Over 75% of the total sample believed that patient referrals would not be affected by the use of soft tissue lasers by orthodontists.
- Personal use of soft tissue lasers by orthodontists and periodontists positively influenced their perceived appropriateness of use by orthodontists.
- None of the observed differences in responses could be attributed to gender or differences in age or year of graduation.

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