2014

Examination of the communication practices and preferences between orthodontists and general dentists

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EXAMINATION OF THE COMMUNICATION PRACTICES AND PREFERENCES BETWEEN ORTHODONTISTS 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.

by

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May 2014

Acknowledgement

I would like to thank the entire VCU Department of Orthodontics for its support the last two years. I would particularly like to thank Dr. Bhavna Shroff for her outstanding dedication and guidance. Her help extended well beyond what would be expected from a thesis advisor and I accredit a large part of where I am today to her support. I would also like to thank Drs. Steven Lindauer, Eser Tüfekçi, and Al Best for their advice and input. Furthermore, I would like to thank my co-residents for providing an incredible atmosphere in which I could pursue my thesis. Finally, I would like to thank my family. I owe tremendous gratitude to my parents for their always present support. I cannot thank my wife, Jeane, enough for her unyielding encouragement.

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Abstract

EXAMINATION OF THE COMMUNICATION PRACTICES AND PREFERENCES BETWEEN ORTHODONTISTS AND GENERAL DENTISTS

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The purposes of this study were to evaluate if orthodontists' and general dentists' perceptions of how often, under what circumstances, and by which media orthodontists communicated with general dentists were similar, and to determine if orthodontists were meeting the communication needs of general dentists. Orthodontists (N=1,000) and general dentists (N=1,000) throughout the United States were randomly selected to participate in a web-based and mailed survey, respectively. The results indicated that the orthodontists communicated with general dentists using the type of media the general dentists preferred to use. As treatment complexity increased, orthodontists shifted from one-way forms of communication to two-way forms of communication ($P < .05$). Both orthodontists and general dentists reported that orthodontists' communication regarding white spot lesions was inadequate. When treating patients with missing or malformed teeth, orthodontists reported they sought input from the general dentists at higher rate than the general dentists reported ($P < .005$).

Introduction

Referrals from general dentists play an important role in the success of an orthodontic practice. The reason why general dentists refer to specific orthodontists has become very important in today's competitive environment. Previous studies have highlighted what factors are important to general dentists when choosing an orthodontist for referrals, including quality of care, cost, convenience, reputation of the orthodontist, patient satisfaction, and communication with the orthodontist.[1-4] Because of the established significance of communication, it is important that orthodontists understand when and how to provide the general dentist with the information he or she desires.

The majority (74%) of referring dentists prefers to receive communication from the orthodontist after the initial orthodontic consult.[2] It is likely that the dentist wants to understand the orthodontic treatment objectives and plan, especially if the patient requires extractions, the restoration of a malformed tooth, or the replacement of a missing tooth. Despite attempts to standardize which, if any, teeth should be extracted[5,6] and the widespread understanding of the available treatment options to restore or replace deformed or missing teeth,[7-12] it is important that both the orthodontist and general dentist agree upon the ultimate treatment goal so that each can facilitate its attainment.

The majority (63%) of general dentists also prefers to receive communication from the orthodontist throughout orthodontic treatment.[2] One area in which proper in-treatment communication is paramount is hygiene. Despite the emphasis on good oral hygiene since the 1930's,[13] white spot lesions (WSLs) continue to be a common finding in orthodontic patients with 25%-97% of all patients developing at least one WSL.[14,15] While 66% of general dentists

believe the patient is the most responsible party for the prevention of WSLs, 82% partly place the responsibility on the orthodontist.[16] Furthermore, approximately one-third of general dentists allow the presence of multiple WSLs at the end of orthodontic treatment to negatively influence their opinion of the orthodontist.[17]

When orthodontic treatment ends, over half of general dentists prefer to receive a written description of treatment and/or patient photographs from the orthodontist.[2] Most general dentists (75%) place equal importance on the overall satisfaction of the patient and the resulting occlusion and function, although their final referral decision is based on their own opinion of orthodontic treatment outcomes.[3]

Not only are the content and frequency of communication between the orthodontist and the general dentist important, but also is the media through which it occurs. A study in 2004 found that general dentists prefer to receive communication from the orthodontist via mail (89%), phone (60%), in person (21%), fax (17%), and email (9%).[1] With the advancement of technology, it is possible that these percentages are outdated, as the ability to share and gather information instantly has allowed for more efficient communication.[18]

Despite the importance of communication between orthodontists and general dentists, a comparison between how orthodontists and general dentists view the communication practices of orthodontists has not been made. The purposes of this study were (1) to evaluate if orthodontists' and general dentists' perceptions of how often, under what circumstances, and by which media orthodontists communicated with general dentists are similar, and (2) to determine if orthodontists are meeting the communication needs of general dentists.

Materials and Methods

An original survey was developed to examine orthodontists' and general dentists' perceptions and preferences of how orthodontists communicated with general dentists. The survey was then customized for both orthodontists and general dentists so that it asked the same questions but was formulated appropriately for the two groups. For instance, the survey for the orthodontists asked how they communicated with general dentists and the survey for general dentists asked how orthodontists communicated with them. The survey consisted of four sections: demographics, types of communication used and preferred, adequacy of orthodontists' communication with general dentists, circumstances and timing of when orthodontists asked general dentists for input (Figures A1 and A2).

Following approval granted by the Institutional Review Board (IRB) at Virginia Commonwealth University (VCU) and the American Association of Orthodontists (AAO), the survey was sent to orthodontists (N=1,000) and to general dentists (N=1,000).

The AAO emailed the survey to orthodontists throughout the United States who were randomly selected from its database of active members. A follow-up email was sent four weeks later to increase participation. Because there was no way to track who responded to the first email and subsequently eliminate them from the second email, the recipients were asked to not participate if they had already done so in the second email.

A third party (VCU Mailing Service) mailed the paper survey, along with a return-addressed stamped envelope, to general dentists throughout the United States who were chosen using the following method. Data from www.statehealthfacts.org provided the percentage of total

dentists in the United States practicing in each state as of November 2012. These percentages were used to create a weighted-average list of the forty-eight continental states. Another list was made with each letter in the alphabet. A state and a letter were then randomly selected and replaced. All dentists from the selected state with the last name beginning with the selected letter were chosen from the list of active members on the American Dental Association (ADA) website. This process was repeated until a list of 5,000 general dentists was generated. From this list, 1,000 general dentists were randomly chosen to receive the survey. The mailed surveys were numbered so that the third-party could track participants. This allowed the follow-up surveys to be mailed only to those who had not returned the survey four-weeks following the original mailing.

The responses were summarized using counts and percentages, or means and standard deviations, as appropriate. Unless otherwise noted, either chi-square or repeated-measures logistic regression is used for all comparisons. All calculations were done with SAS software (JMP pro version 10, SAS version 9.3, SAS Institute Inc., Cary NC).

Results

A total of 137 orthodontists and 144 general dentists responded to the survey. **Error! Reference source not found.**e 1 shows the demographic characteristics of the participants.

Table 1. Demographic characteristics of survey participants

	General dentists		Orthodontists		
Characteristic	%	(n)	%	(n)	P-value*
Gender					0.5347
Female	27	(38)	24	(32)	
Male	73	(104)	76	(104)	
What type of environment do you practice in?					0.9450
Rural	18	(25)	16	(22)	
Suburban	63	(89)	65	(87)	
Urban	19	(27)	19	(25)	
What type of practice do you work in?					0.0032
Solo practice	69	(96)	64	(88)	
Group practice	31	(44)	30	(41)	
Academic	0	(0)	6	(8)	
	Mean	SD	Mean	SD	
Age (yrs)	51.9	9.93	47.1	9.94	<.0001
Years in practice	24.7	10.28	17.1	10.18	<.0001

* Nominal responses were compared using chi-square and continuous responses were compared using a t-test.

The two groups were predominantly male and typically practiced in a suburban environment. Slightly fewer orthodontists practiced solo than did general dentists (64% vs. 69%) and the only respondents who worked in academics were orthodontists (6% vs. 0%, P=0.0032). General dentists who responded were older (mean, 52 years old vs. 47 years old) and had practiced more years than the orthodontists who responded (mean, 25 years vs. 17 years, P<.0001).

Media used to communicate

Table 2 shows the types of communication general dentists said they actually received and what they preferred to receive from orthodontists and what orthodontists said they actually sent and what they preferred to send to general dentists.

Table 2. Actual and preferred media used in communication by general dentists and orthodontists for the average/typical patient and for the complex patient

	General dentists			Orthodontists		
	%	*	n	%	*	n
What type of communication do you receive/How do you communicate regarding an AVERAGE/TYPICAL orthodontic patient?						
Letter	94	A	136	86	A	118
Email	26	C	37	55	B	76
In-person	22	C	32	34	C	47
Phone	53	B	76	51	B	70
Fax	20	X	29	13	X	18
Mobile device App	2	X	3	5	X	7
Other:	1	X	2	4	X	5
What type of communication do you prefer to receive/How would you prefer to communicate regarding an AVERAGE/TYPICAL orthodontic patient?						
Letter	74	A	106	30	A	41
Email	35	B	50	49	A	67
In-person	13	C	19	11	B	15
Phone	40	B	57	6	B	8
Fax	9	X	13	0	X	0
Mobile device App	0	X	0	3	X	4
Other:	0	X	0	1	X	2
What type of communication do you receive/How do you communicate regarding a COMPLEX orthodontic patient?						
Letter	83	A	119	71	B	97
Email	17	C	25	54	C	74
In-person	37	B	53	71	B	97
Phone	74	A	107	86	A	118
Fax	13	X	18	6	X	8
Mobile device App	1	X	1	3	X	4
Other:	1	X	1	4	X	5

	General dentists			Orthodontists		
	%	*	n	%	*	n
What type of communication do you prefer to receive/How would you prefer to communicate regarding a COMPLEX orthodontic patient?						
Letter	57	A	78	10	A	14
Email	28	B	39	15	B	20
In-person	36	B	50	42	B	57
Phone	60	A	82	30	A	41
Fax	7	X	9	0	X	0
Mobile device App	0	X	0	0	X	0
Other:	0	X	0	4	X	5

* The communication forms are compared within each practitioner group and survey question using a repeated-measures logistic regression and Tukey's HSD. Percentages not sharing the same superscript are significantly different (P<0.05). The less used forms—Fax, App and other—were not used in the comparison because of lack of data and all are grouped together with the "X" superscript.

The results were based on whether or not the patient was of average/typical treatment complexity or required a more complex treatment. When considering the differences between how the orthodontists and general dentists responded, despite the higher average age of general dentists, age was not a significant predictor of the use of the media types.

With regard to the average/typical patient, general dentists said that they received a letter (94%) from orthodontists significantly more than they received phone calls (53%), emails (26%), or communicated in-person (22%, P<.05). Furthermore, general dentists preferred to receive letters (74%) significantly more than they preferred to receive phone calls (40%) or emails (35%), which in turn they preferred significantly more than in-person meetings (13%, P<0.5). Orthodontists said they sent letters (86%) significantly more than they sent emails (55%) or made phone calls (51%) to the general dentists, which in turn they did significantly more than they made in-person contact (34%, P<.05).

With regard to the more complex patient, general dentists said they received a letter (83%) or a phone call (74%) significantly more than in-person contact (37%), which in turn they received significantly more than an email (17%, P<.05). They preferred to receive a phone call (60%) or letter (57%) the same amount, each of which was preferred significantly more than in-person contact (36%) or email (28%). Orthodontists said they communicated with general dentists about the more complex patient primarily by phone (86%). This was significantly more than by letter (71%) or in-person (71%, P<.05). They communicated via email the least often (54%, P<.05).

Table 3 compares the frequency that general dentists said they actually received and preferred to receive each type of communication to the frequency that orthodontists said they completed each type of communication for both the average/typical patient and the complex patient.

Table 3. Comparison of each type of media used to communicate

Type of Communication: Letter

Group	Type of Patient	Actual or Preferred	Mean	95%CI		Tukey HSD
General Dentist	Average	Actual	94.4%	89.3%	97.2%	A
General Dentist	Average	Preferred	73.6%	65.8%	80.2%	BC
General Dentist	Complex	Actual	82.6%	75.6%	88.0%	BC
General Dentist	Complex	Preferred	55.9%	47.5%	63.9%	D
Orthodontist	Average	Actual	86.1%	79.3%	91.0%	AB
Orthodontist	Average	Preferred	29.9%	22.9%	38.1%	E
Orthodontist	Complex	Actual	70.8%	62.7%	77.8%	CD
Orthodontist	Complex	Preferred	10.2%	6.1%	16.5%	F

Type of Communication: Email

Group	Type of Patient	Actual or Preferred	Mean	95%CI		Tukey HSD
General Dentist	Average	Actual	25.7%	19.2%	33.5%	CD
General Dentist	Average	Preferred	34.7%	27.4%	42.8%	BC

General Dentist	Complex	Actual	17.4%	12.0%	24.4%	D
General Dentist	Complex	Preferred	27.9%	21.1%	35.9%	CD
Orthodontist	Average	Actual	55.5%	47.1%	63.6%	A
Orthodontist	Average	Preferred	48.9%	40.6%	57.2%	AB
Orthodontist	Complex	Actual	54.0%	45.6%	62.2%	A
Orthodontist	Complex	Preferred	14.6%	9.6%	21.6%	D

The following additional pair is also significantly different: (GP Average Do,GP Complex Do).

Type of Communication: In-Person Contact

Group	Type of Patient	Actual or Preferred	Mean	95%CI		Tukey HSD
General Dentist	Average	Actual	22.2%	16.2%	29.7%	CD
General Dentist	Average	Preferred	13.2%	8.6%	19.8%	D
General Dentist	Complex	Actual	36.8%	29.3%	45.0%	B
General Dentist	Complex	Preferred	36.1%	28.5%	44.4%	BC
Orthodontist	Average	Actual	34.3%	26.9%	42.6%	BC
Orthodontist	Average	Preferred	11.0%	6.7%	17.4%	D
Orthodontist	Complex	Actual	70.8%	62.7%	77.8%	A
Orthodontist	Complex	Preferred	41.6%	33.7%	50.0%	B

Type of Communication: Phone Call

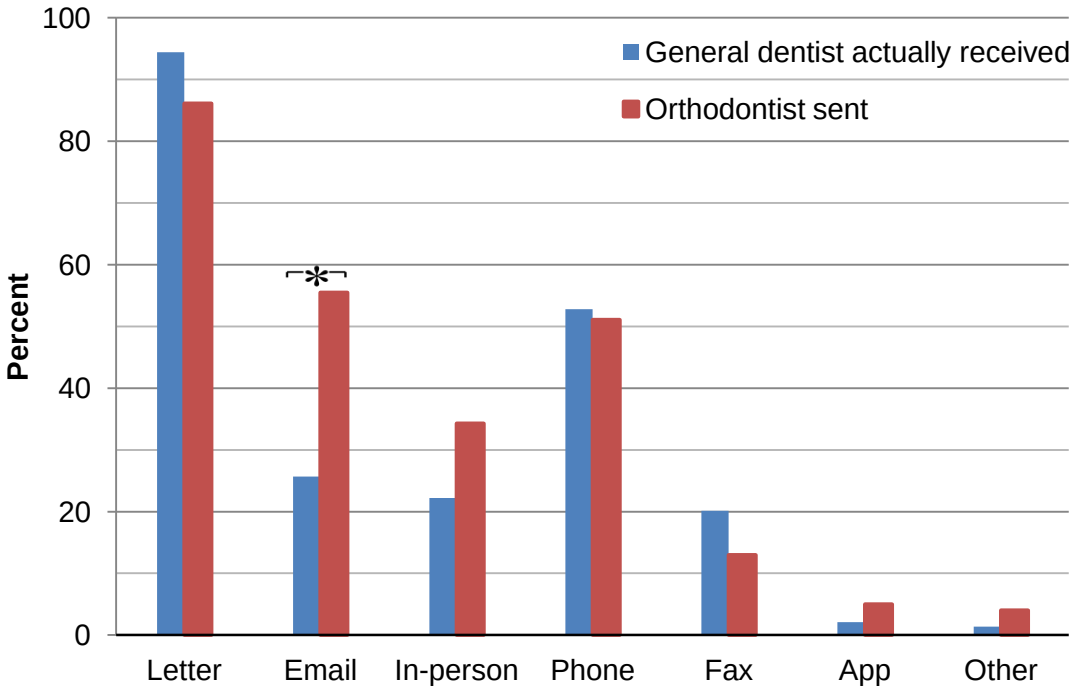
Group	Type of Patient	Actual or Preferred	Mean	95%CI		Tukey HSD
General Dentist	Average	Actual	52.8%	44.6%	60.8%	BC
General Dentist	Average	Preferred	39.6%	31.9%	47.8%	CD
General Dentist	Complex	Actual	74.3%	66.6%	80.8%	A
General Dentist	Complex	Preferred	59.4%	51.0%	67.2%	B
Orthodontist	Average	Actual	51.1%	42.8%	59.4%	BC
Orthodontist	Average	Preferred	5.8%	2.9%	11.2%	E
Orthodontist	Complex	Actual	86.1%	79.3%	91.0%	A
Orthodontist	Complex	Preferred	29.9%	22.9%	38.1%	D

It filters the results first by the type of communication and then by who gave the response, whether the patient being communicated about was average/typical or complex, and if the response was with regard to the actual or preferred way of communicating. Note that the means in Table 3 were slightly different from the raw means reported in Table 2 because the Table 3 means were generated from repeated measures ANOVA.

General Dentists Actually Received vs. Orthodontists Actually Provided – Average Patient

Both groups reported that the most common type of communication from orthodontists for the average/typical patient was a letter (Table 2) and both agreed on the amount this occurred (Table 3, Figure 1).

Figure 1. Communication regarding the average/typical patient: What general dentists reported they received compared to what orthodontists reported they sent. *P < .05

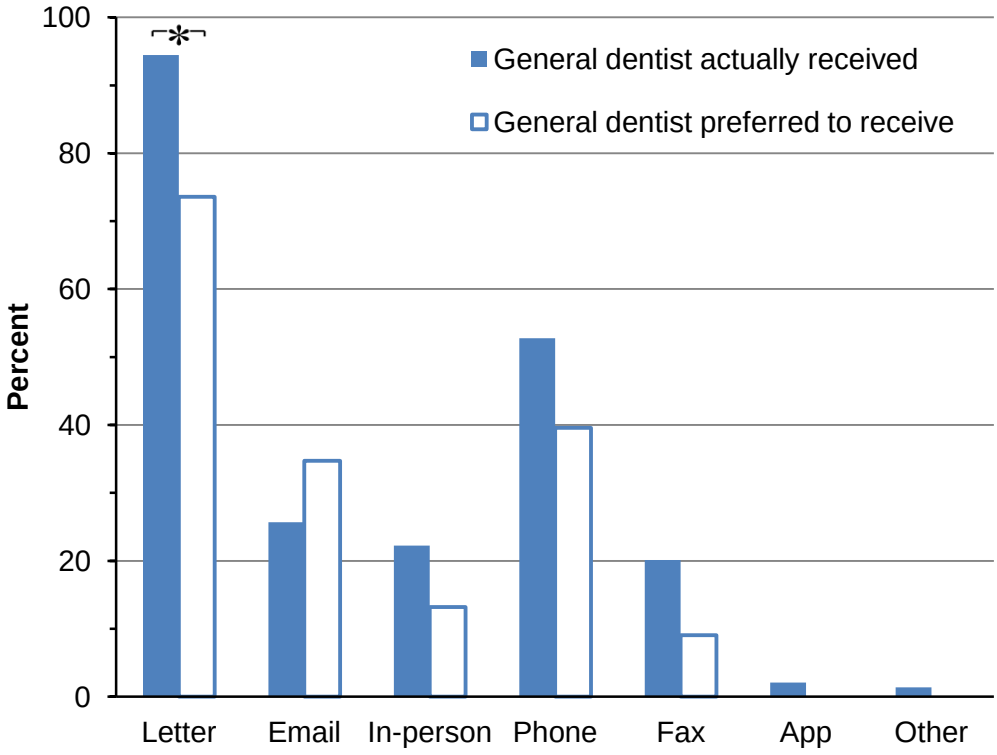


They disagreed, however, on how often emails were sent. General dentists said they received emails only 26% of the time but the orthodontists reported sending emails more than twice as often (56%, P<.05). Both groups agreed on the amount that in-person contact and phone calls were made.

General Dentists Actually Received vs. General Dentists Preferred to Receive – Average Patient

Regarding the average patient, general dentists received most types of communication at a statistically similar rate they preferred to receive to them (Table 3, Figure 2).

Figure 2. Communication regarding the average/typical patient: What general dentists reported they received compared to what general dentists preferred to receive. *P < .05

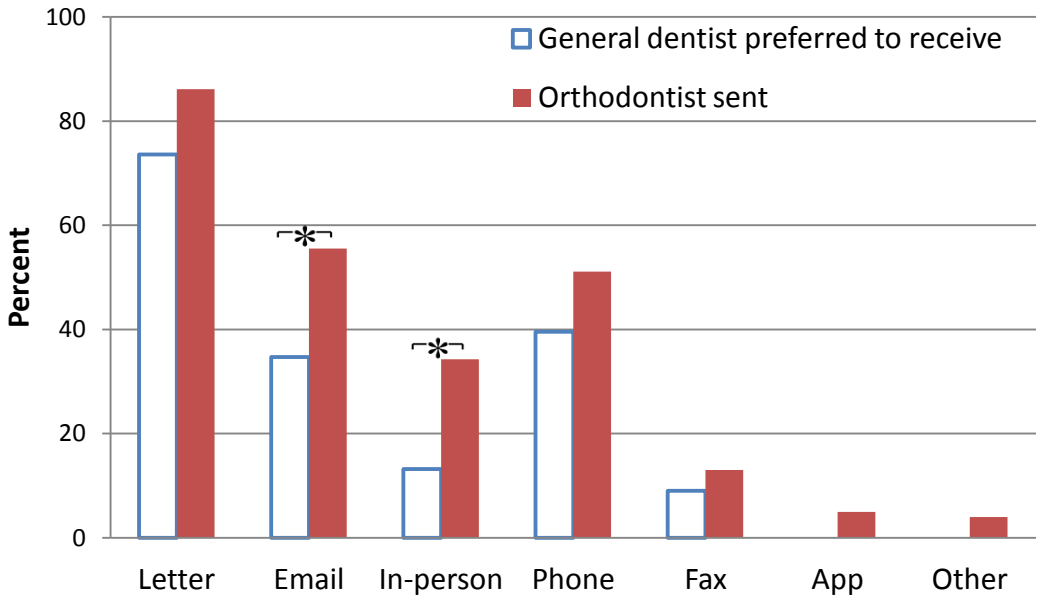


In fact, the only form of communication that was received at a rate statistically significantly different than what was preferred was the letter. 94% of general dentists reported they received letters compared to the 74% who indicated they preferred to receive letters (P<.05).

General Dentists Preferred to Receive vs. Orthodontists Actually Provided – Average Patient

It is of value to compare the type of communication general dentists preferred to receive to the type of communication orthodontists reported they provided. These comparisons are seen in Table 3 and Figure 3.

Figure 3. Communication regarding the average/typical patient: What general dentists preferred to receive compared to what orthodontists reported they sent. *P < .05

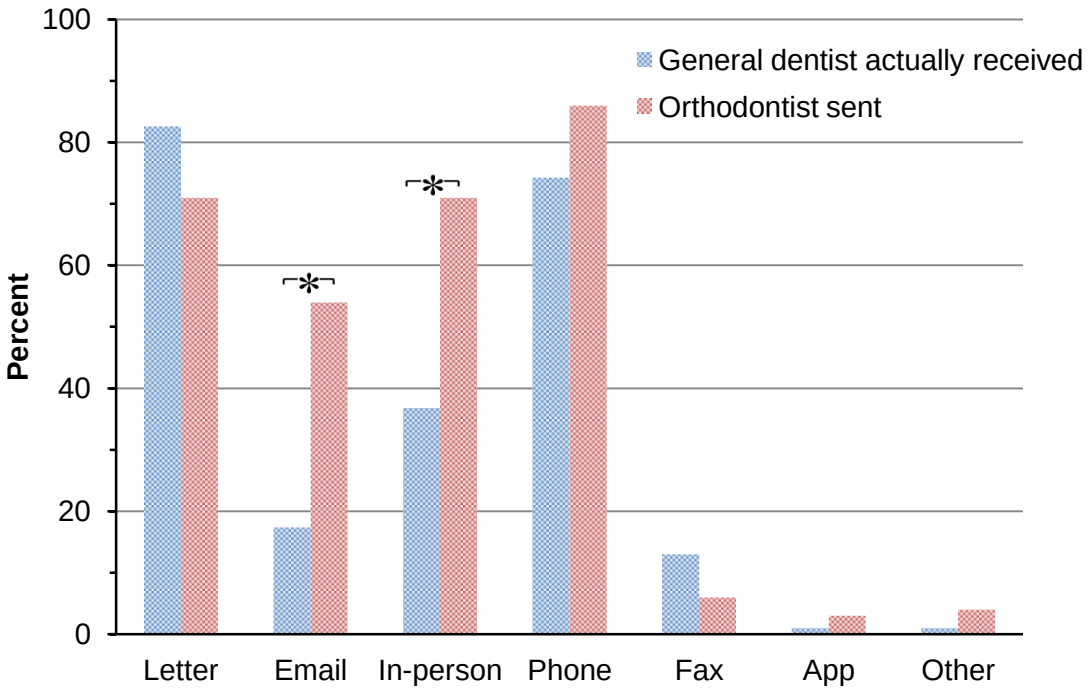


As mentioned, for the average patient, general dentists preferred to receive a letter (74%) more than any other type of communication. Orthodontists reported they sent letters with a similar rate (86%, P>.05). General dentists, although not as frequently, often preferred to receive a phone call or email (40%, and 35%, respectively). Orthodontists said they made phone calls at a similar frequency (51%, P>.05) but sent emails at a significantly higher rate (56%, P<.05). Orthodontists also said they tried to make in-person contact at a higher rate (34%) than the general dentists reported they preferred to meet (13%, P<.05).

General Dentists Actually Received vs. Orthodontists Actually Provided – Complex Patient

With regard to the more complex patient, both groups agreed that letters and phone calls were the most frequent ways the orthodontists communicated with the general dentists (Table 2) and on the frequency each type of communication was made (Table 3, Figure 4).

Figure 4. Communication regarding the complex patient: What general dentists reported they received compared to what orthodontists reported they sent. *P < .05

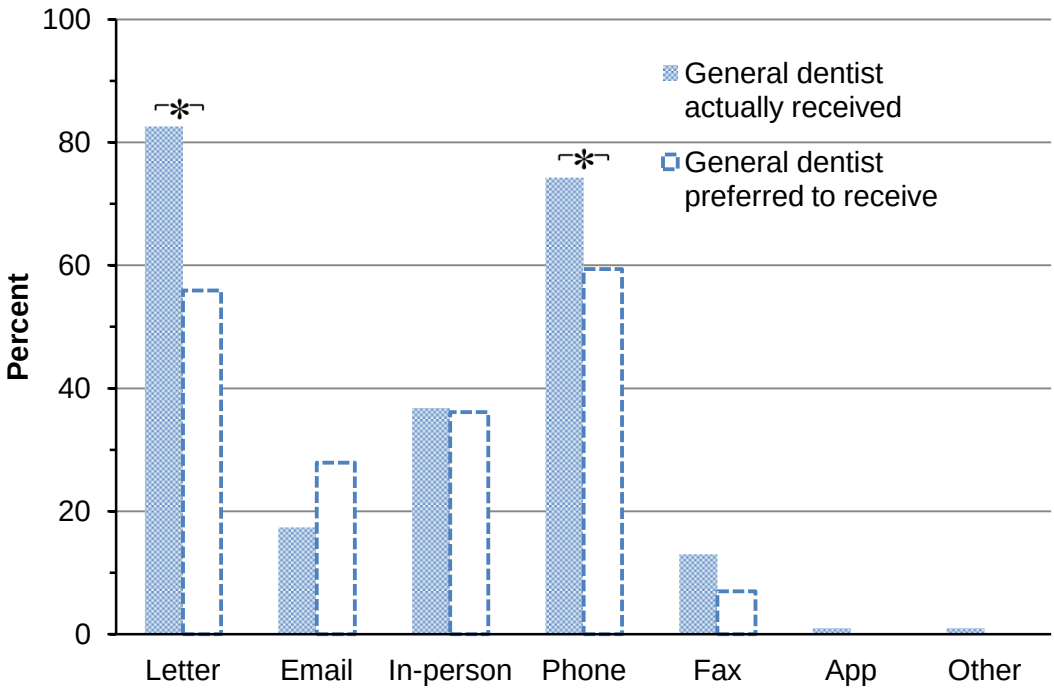


They disagreed, however, on how often emails were sent and in-person contact was made (Table 3). Orthodontists reported much higher numbers (54% and 71%, respectively) than did the general dentists (17% and 37%, respectively, P<.05).

General Dentists Actually Received vs. General Dentists Preferred to Receive – Complex Patient

What the general dentists preferred to receive and what they actually received did not always coincide with regard to the complex patient. Table 2 shows that a letter and a phone call were the most preferred and most received types of communication. However, Table 3 and Figure 5 indicate that general dentists received each type of communication at a much higher rate than they preferred to (P<.05).

Figure 5. Communication regarding the complex patient: What general dentists reported they received compared to what general dentists preferred to receive. *P < .05

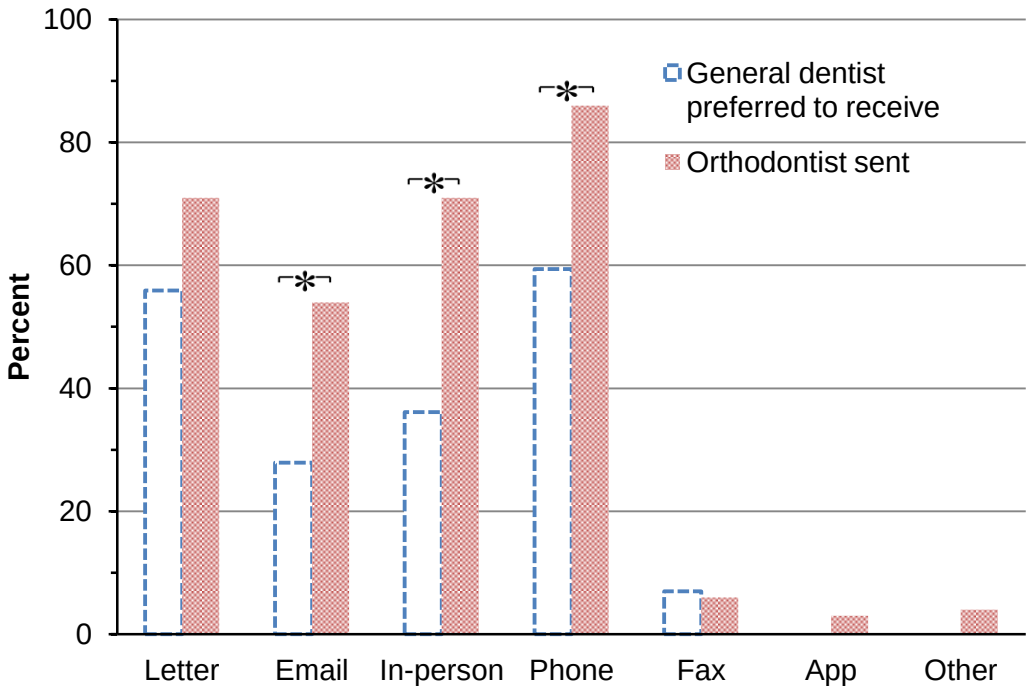


General dentists received emails and in-person contact at similar rates to what they preferred (P>.05).

General Dentists Preferred to Receive vs. Orthodontists Actually Provided – Complex Patient

Regarding the complex patient, general dentists preferred to receive a phone call (59%) or a letter (56%, Table 3). Orthodontists reported they made phone calls (86%) significantly more often than the general dentists preferred (P<.05, Figure 6).

Figure 6. Communication regarding the complex patient: What general dentists preferred to receive compared to what orthodontists reported they sent. *P < .05

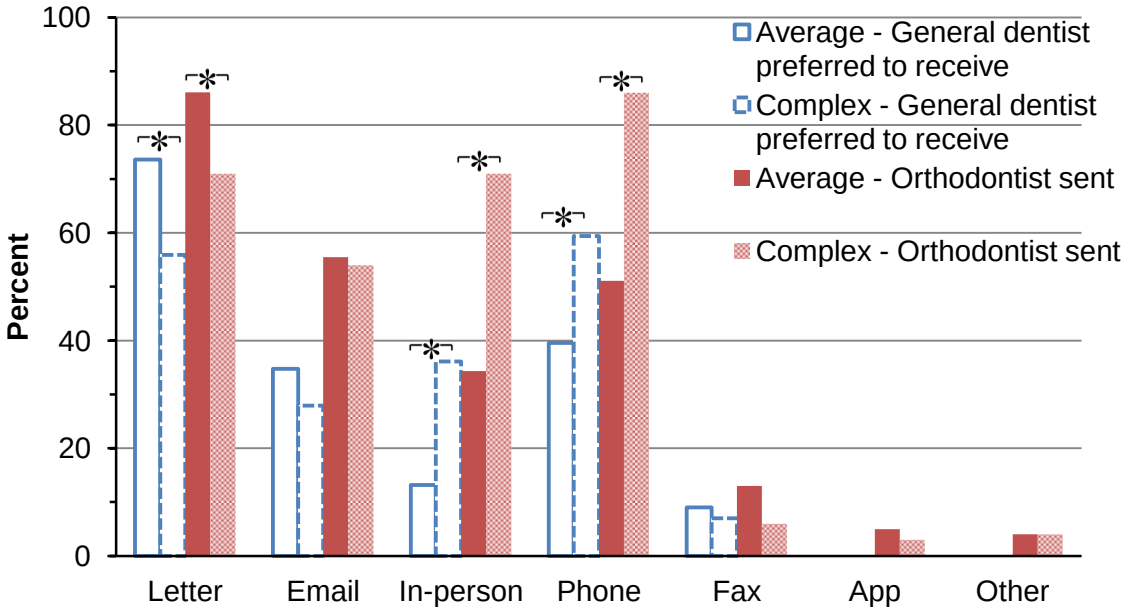


However, they mailed letters at a similar frequency (71%). With regard to sending emails or meeting in person about complex patients, orthodontists reported they did so more than general dentists preferred (54% vs. 28%, 71% vs. 36%, respectively; P<.05).

Average vs. Complex Patient

The differences in how the general dentists preferred to communicate and how orthodontists communicated based on whether the patient was an average/typical patient or a complex patient are reported in Table 3 and Figure 7.

Figure 7. Communication preferences and practices among general dentists and orthodontists regarding the average patient versus the complex patient. *P < .05



General dentists preferred to receive in-person communication or a phone call at a significantly higher rate when treating complex patients compared to when treating average/typical patients (36% vs. 13%, 59% vs. 40%, respectively; P<.05). The preference to receive a letter or email decreased, when shifting from an average/typical patient to a complex patient. However, this difference was significant for letters (74% vs. 56%, P<.05) but not for emails (35% vs. 28%, P>.05). The orthodontists showed a similar trend in how their communication practices changed with the type of patient. The in-person and phone call communication both showed a significant increase with regard to a complex patient versus an average/typical patient (71% vs. 34%, 86% vs. 51%, respectively; P<.05). They also communicated less by letter or email when working on a complex patient, although only the difference in how often letters were sent was significant.

When communicating by letter, the rate dropped from 86% to 71% (P<.05). For email, the communication rate dropped from 56% to 54% (P>.05).

Adequacy of communication

Both general dentists and orthodontists were asked a series of questions regarding how adequately orthodontists communicated with general dentists regarding extractions, patients' poor oral hygiene, and the development of white spot lesions (WSLs) during orthodontic treatment. The results are shown in Table 4.

Table 4. Adequacy of communication

	General dentists		Orthodontists		
	%	n	%	n	P-value*
What percentage of the time are you notified by your orthodontists/do you notify your referring general dentists when teeth are to be extracted for orthodontic reasons?					0.0036
0%	1	1	0	0	
1-25%	13	18	6	8	
26-50%	4	5	2	3	
51-75%	5	7	4	5	
76-99%	22	31	14	19	
100%	56	80	74	98	
How adequately do you receive/do you provide communication regarding…					0.0399
… a patient's poor oral hygiene?					
Inadequately	47	66	54	74	
Adequately	53	75	43	59	
Excessively	0	0	2	3	
…developing white spot lesions?					0.0109
Inadequately	70	100	57	77	
Adequately	30	42	41	56	
Excessively	0	0	2	3	

* The two groups were compared using a t-test on the first question and a likelihood ratio chi-square on the second and third.

With regard to how often orthodontists notified the referring general dentist when the orthodontist wanted teeth extracted, the majority of both groups reported that the orthodontists

did so 100% of the time. However, whereas orthodontists claimed an average rate of communication of 91% (SD=22%), general dentists reported they received communication only 82% of the time (SD=30.5%, P=0.0036).

When asked about the adequacy of communication regarding poor oral hygiene, the difference between the responses of the two groups was slight but statistically significant. 47% of the general dentists reported that orthodontists communicated inadequately while 53% said they did so adequately. This was in contrast to the 54%, 43%, and 2% of orthodontists who reported they communicated about poor oral hygiene inadequately, adequately, and excessively, respectively (P=0.0399).

When asked about the adequacy of communication regarding the development of WSLs, the majority of both groups agreed that the level of communication was inadequate. However, the general dentists were more dissatisfied, with 70% compared to 57% of orthodontists reporting the communication was inadequate (P=0.0109). Only 30% of general dentists reported the communication was adequate while 41% of orthodontists believed it was adequate.

Circumstances and timing when input was sought from general dentists

The general dentists and orthodontists were asked a group of questions about what percentage of the time orthodontists asked general dentists for input regarding specific clinical situations. Table 5 summarizes the results.

Table 5. Percent of the time orthodontists asked general dentists for input

	General dentists		Orthodontists		
	%	n	%	n	P-value*
When orthodontists treat patients with malformed teeth:					0.0004
0%	22	32	7	9	
1 to 25%	27	38	26	35	
26 to 50%	13	18	10	14	
51 to 75%	13	19	12	17	
76 to 99%	8	11	28	38	

100%	17	25	18	24	
When orthodontists treat patients with missing teeth:					0.0019
0%	19	28	1	2	
1 to 25%	20	29	19	25	
26 to 50%	11	16	16	21	
51 to 75%	16	23	20	27	
76 to 99%	13	19	28	38	
100%	20	29	16	22	
When orthodontists determine the goals of treatment with regard to occlusion:					0.652
0%	42	60	24	33	
1 to 25%	24	35	45	62	
26 to 50%	7	10	7	9	
51 to 75%	10	14	14	19	
76 to 99%	6	8	4	6	
100%	12	17	6	8	
When orthodontists are nearing the end of orthodontic treatment and cannot obtain ideal results:					0.9377
0%	26	38	4	6	
1 to 25%	20	29	39	53	
26 to 50%	10	14	15	21	
51 to 75%	11	16	15	20	
76 to 99%	15	22	18	25	
100%	17	25	8	11	
When orthodontists are nearing the end of orthodontic treatment and can obtain ideal results:					0.0012
0%	45	64	56	77	
1 to 25%	22	31	27	37	
26 to 50%	8	12	4	5	
51 to 75%	5	7	5	7	
76 to 99%	8	11	4	6	
100%	13	18	4	5	

* The two groups were compared using a t-test.

Orthodontists reported that they asked for input from general dentists when treating patients with malformed teeth at a higher rate (56.9%, SD=36.7%) than the general dentists reported (40.9%, SD=37.9%, P=0.0004). The disparity was clear when the distribution of answers was considered. 49% of general dentists said that orthodontists asked for their input

25% of the time or less while 46% of the orthodontists said they asked for input 75% of the time or more.

When treating patients with missing teeth, orthodontists again reported they asked for the input from general dentists at a higher rate (62.0%, SD=32.0%) than the general dentists reported (48.7%, SD=38.8%, P=0.0019). Only 1% of orthodontists reported they never asked for input while 19% of general dentists reported they were never asked for input.

The orthodontists and general dentists agreed about the frequency that orthodontists sought input regarding the goals of treatment with regard to occlusion. The orthodontists reported this occurred 26.8% of the time (SD=30.5%) and the general dentists reported this occurred 28.6% of the time (SD=36.4%, P=0.652). The vast majority of both groups reported this occurred less than half of the time.

The orthodontists and general dentists also agreed on the frequency that orthodontists sought input when orthodontists were approaching the end of treatment and could not obtain ideal results. Each indicated this occurred roughly 44% of the time (P>.9). Orthodontists claimed that they asked for input less infrequently than the general dentists reported, but these differences were not statistically significant.

The orthodontists and general dentists did not agree on the frequency that orthodontists sought input when orthodontists were reaching the end of treatment and could obtain ideal results. The general dentists reported this occurred at a higher rate of 28.4% (SD=37.5%) compared to the orthodontists' reported rate of 15.6% (SD=27.7%, P=0.0012). Despite the 13% of general dentists who claimed this occurred 100% of the time, 67% claimed that it occurred 25% of the time or less. Orthodontists claimed it happened even less frequently, with only 4% reporting they always asked for input and 84% reporting to do so 25% of the time or less.

Both groups were also asked a series of questions regarding the timing of when orthodontists seek input from general dentists with regard to certain situations. The results are shown in Table 6.

Table 6. The point in treatment when orthodontists asked general dentists for their input

	General dentists		Orthodontists		
	%*	n	%*	n	P-value**
When orthodontists treat patients with malformed teeth …					
…at the beginning	48	67	69	93	0.0003
…in the middle	15	21	22	29	0.1489
…at the end	25	35	42	56	0.0030
…they/I do not ask for input	38	54	7	10	<.0001
When orthodontists treat patients with missing teeth …					
…at the beginning	51	72	75	100	<.0001
…in the middle	18	25	23	31	0.2672
…at the end	28	39	42	56	0.0143
…they/I do not ask for input	36	51	6	8	<.0001
When orthodontists determine the goals of treatment with regard to occlusion…					
…at the beginning	26	37	42	56	0.0068
…in the middle	10	14	10	14	0.8870
…at the end	13	19	12	16	0.7028
…they/I do not ask for input	66	93	49	66	0.0053

*The questions allowed for "check all that apply" so the percentages do not add to 100%.
** The general dentist and orthodontist are compared a repeated-measures logistic regression model. The uncorrected p-values should be compared to a Bonferroni-corrected alpha=0.0025.

With regard to when input is sought while treating malformed teeth, 69% of orthodontists reported they did so at the beginning of treatment but only 48% of general dentists agreed (P<.0001). In fact, 7% of orthodontists reported they did not ask for input when treating malformed teeth compared to a significantly higher 38% of general dentists who claimed

orthodontists did not ask for input (P<.0001). Orthodontists also reported a higher rate of asking for input at the end of treatment than did the general dentists (42% vs. 25%, P=0.003).

When patients with missing teeth were treated, a significantly higher percentage of general dentists (36%) answered that they were never asked for their input compared to the 6% of orthodontists who claimed to not ask for input (P<.0001). 75% of orthodontists reported they asked for input at the beginning of treatment but only 51% of general dentists agreed (P<.0001). The orthodontists and general dentists did agree, however, about how often the orthodontists asked for input during and at the end of treatment (P=0.272 and P=0.0143, respectively).

The orthodontists and general dentists agreed on how often orthodontists sought input when they were deciding the goals of treatment with regard to occlusion. Both groups reported that if the orthodontists did ask for input, they tended to do so at the beginning of treatment and rarely did so at the middle or end of the treatment (P>.0025).

Discussion

The results from this study indicated that orthodontists and general dentists tended to agree on how orthodontists communicated with general dentists and that, for the most part, the communication was adequate. The results can be divided into the following categories: media used to communicate, adequacy of communication, and the circumstances and timing of when input was sought from general dentists.

Media used to communicate

The results from this study presented both similarities and differences to a previous study with regard to how general dentists preferred to receive communication from orthodontists.[1] Both studies showed that general dentists preferred to receive a letter (mail) or phone call from the orthodontist more than any other type of communication. However, they differed in that the previous study indicated that only 8.7% of general dentists preferred to receive an email whereas 28-35% of general dentists preferred to receive an email in the current study. This marked increase is likely due to the vast improvements in technology and more friendly user interfaces that have developed since the first study was published in 2004.

The orthodontists and the general dentists generally agreed on the amount each type of media was used by orthodontists when contacting the general dentists for all types of patients. These similarities indicated that general dentists received and paid attention to the orthodontists' communication and therefore most information reached its intended recipient. The biggest difference in the reported amounts of actual communication dealt with email. Interestingly, orthodontists claimed to communicate with email at a much higher rate than the general dentists

indicated they received emails. This was true for both the average/typical patient and the complex patient. A possible explanation of this might be that the emails got filtered into the "Spam" mailbox and were never available for the general dentist to see. Also, if the general dentist received many emails per day, there was the chance that an email from the orthodontist got lost in the multitude of emails through which the general dentist had to navigate and was either never opened or opened and forgotten about.

Providing the right form of communication to general dentists is a delicate balance for the orthodontist. Not using the preferred form has its obvious consequences, but using too many forms could desensitize the general dentist to the importance of the information communicated. Fortunately, for both the average/typical patient and the complex patient, orthodontists and general dentists agreed that the amount orthodontists used each type of media to communicate with the general dentist matched how general dentists preferred to receive communication.

Regarding the average/typical patient, general dentists preferred to receive letters vastly more than any other form of communication. Phone calls and emails were preferred second by the general dentists, roughly 35-40% less than receiving a letter. Orthodontists accommodated these preferences by sending letters the vast majority of the time and making phone calls and sending emails roughly 30-35% less frequently than they sent letters.

For the more complex patient, the communication preferences and practices changed similarly. General dentists no longer preferred to receive a letter at a rate vastly higher than the other forms and placed equal weight on receiving a phone call. This was understandable because complex patients often require high levels of coordination between practitioners to ensure the patient receives the best possible outcome in a timely manner. Fortunately, the orthodontists met this increase in expected communication, as the amount that general dentists and orthodontists

said the orthodontists made phone calls surpassed the rate at which general dentists preferred to receive them.

The results for both the average/typical patient and the complex patient showed that the orthodontists met the communication needs of the general dentists with regard to how they communicated. This indicated that the orthodontists listened to what general dentists wanted and made the effort to accommodate them.

Whatever media is used to communicate, both groups will need to ensure that all communication is in compliance with the Health Insurance Portability and Accountability Act (HIPAA). Regulations continue to evolve to protect the private information of all patients and it is the responsibility of all practitioners to conform to these standards, even if it means changing the ways communication is made.

Adequacy of communication

While general dentists reported they were notified less often than the orthodontists reported they notified the general dentists when they wanted teeth to be extracted for orthodontic purposes (82% vs 91%, P=0.0036), the clinical effect of this difference did not appear to be significant, as the majority of both groups reported this type of communication occurred. This was not surprising because general dentist offices routinely perform the simple extractions that are necessary for orthodontic treatment.

The majority of general dentists rated the orthodontists' communication as adequate with regard to patients who had poor oral hygiene yet inadequate with regard to patients who had developing WSLs. This was a surprising result because poor oral hygiene is a precursor to WSLs so one might have assumed that the communication practices would have been similar. Perhaps this difference was because WSLs can develop is as little as 4 weeks.[19] Even if orthodontists

made the general dentists aware of poor oral hygiene when it first became an issue, the orthodontists might not have had the opportunity to inform the general dentists about WSLs if the patient saw the general dentist between orthodontic appointments. Orthodontists also may not have informed the general dentists about WSLs because they knew that certain treatment modalities can provide remineralization and esthetic enhancements following orthodontic treatment.[20]

Interestingly, the majority orthodontists rated their communication about poor oral hygiene and developing WSLs as inadequate. Perhaps they attempted to handle these issues within their own practice without the help of the general dentist, or perhaps they did not want to admit to the general dentist when these issues occurred for pride or legal reasons. Regardless of the reason, this is an area where orthodontists can improve how they communicate with the general dentists. If the patient is told about the importance of good oral hygiene by both the orthodontist and the general dentist, the development and progression of WSLs could be prevented.

Circumstances and timing when input was sought from general dentists

When treating patients with malformed or missing teeth, there were large disparities between how much the orthodontists and general dentists said the orthodontists asked for input from the general dentists and when that input was actually sought. The orthodontists reported they sought input from the general dentists at a higher overall rate than the general dentists claimed, and also at a higher rate at the beginning and end of treatment than the general dentists claimed. Kokich and Spear discussed a series of questions about restoring missing and malformed teeth that must be answered prior to the removal of braces.[21] According to these authors, a consensus can only be attained by adequate, two-way communication between the

general dentist and orthodontist. They recommended that the general dentist be involved in the finishing phase of orthodontic treatment. This communication benefits the patient, the general dentist, and the orthodontist because each general dentist may have unique preferences about how they want missing or malformed teeth managed. It therefore ensures that all parties understand the goal of treatment and treat the patient accordingly, thus maximizing efficiency and clinical results. The difference in the perceptions of how often and when the orthodontists reached out to general dentists indicated that the management of missing or malformed teeth is an area where communication must be improved.

Orthodontists and general dentists agreed on how often and when the orthodontists asked for input about the goals of treatment with regard to occlusion. Both groups indicated that input was sought less than half of the time, typically at the beginning of treatment when it did occur. Perhaps this was because both groups assumed that the goal for all orthodontic treatment should be Class I canines with Class I molars, or, in the case of anteroposterior skeletal discrepancies, Class I canines with Class II or III molars. Because it was assumed, it did not need to be discussed as often.

Both the orthodontists and general dentists agreed on how often the orthodontists asked for input when they could not obtain ideal results at the end of orthodontic treatment. They agreed this happened roughly 44% of the time. Perhaps the orthodontists did not feel the need to communicate because they assumed the general dentists knew they did everything in their power to maximize the treatment result for the patient. Or, the orthodontists may not have wanted to draw attention to non-ideal results. When ideal results could be obtained, the general dentists reported they were asked for input at a significantly higher frequency than the orthodontists

reported they asked for input (28.4% vs. 15.6%, P=0.0012). Despite the statistical significance, each of these rates is relatively low and the difference did not offer any practical significance.

Conclusions

- Orthodontists met the needs of general dentists with regard to how general dentists preferred to receive communication. As the treatment complexity of orthodontic patients increased, orthodontists and general dentists shifted from one-way forms of communication (letters) to two-way forms of communication (phone calls).
- Orthodontists did not meet the needs of general dentists with regard to developing white spot lesions, as both groups indicated the communication was inadequate.
- When treating patients with malformed or missing teeth, orthodontists reported they sought input from the general dentists at a much higher rate than general dentists reported the orthodontists sought input.
- When orthodontists sought input from general dentists regarding the treatment of missing or malformed teeth, both groups agreed that they tended to do so at the beginning of treatment more than any other time during treatment.

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Appendices

Figure A1. Survey sent to orthodontists

Evaluation of the communication between orthodontists and general dentists

VIRGINIA COMMONWEALTH UNIVERSITY

Thank you for taking time to complete this survey. The survey will take less than five minutes to complete and your participation is completely voluntary.

The purposes of this study are (1) to examine how orthodontists communicate with general dentists and (2) to compare orthodontists' perception of communication with that of general dentists.

While we understand that your level and frequency of communication may differ with each general dentist, please answer the questions based on your average experiences.

There will be no identifying information to link you to your responses and no one will know that you took this survey. Your answers will be compiled and used for a research project that will be presented at professional meetings and used in publications.

If you have any questions, complaints, or concerns about the research, please contact:

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Subjects Protection
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1) Age: _____
2) Gender: _____
3) Number of years in practice: _____
4) What type of environment do you practice in?
   □ Rural □ Suburban □ Urban
5) What type of practice do you work in?
   □ Solo practice □ Group practice □ Academic □ Military

6) Please answer the following questions about how you communicate with your referring general dentists regarding average/traditional orthodontic treatment and more complex orthodontic treatment (ie, malformed or missing teeth, implant placement, etc).

	Average/Traditional Treatment	More Complex Treatment
How do you communicate? *Please check **ALL** that apply.*	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____
How would you prefer to communicate? *Please check **ONE**.*	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____
During treatment, at what point(s) do you communicate? *Please check **ONE**.*	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when they ask	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when they ask
During treatment, at what point(s) would you prefer to communicate? *Please check **ONE**.*	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when they ask	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when they ask

7) What percentage of the time do you notify your referring general dentists when you want teeth extracted for orthodontic reasons?

□ 0% □ 1-25% □ 26-50% □ 51-75% □ 76-99% □ 100%

8) How adequately do you feel you communicate with your referring general dentists regarding the following?

	Inadequately	Adequately	Excessively
A patient's poor oral hygiene?	□	□	□
Developing white spot lesions?	□	□	□

9) What percentage of the time do you ask for input from your referring general dentists regarding the following?

	0%	1 - 25%	26 - 50%	51 - 75%	76 - 99%	100%
When you treat patients with malformed teeth?	□	□	□	□	□	□
When you treat patients with missing teeth?	□	□	□	□	□	□
When you are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□	□	□
When you are nearing the end of orthodontic treatment and cannot obtain ideal results?	□	□	□	□	□	□
When you are nearing the end of orthodontic treatment and can obtain ideal results?	□	□	□	□	□	□

10) If applicable, at what point during orthodontic treatment do you **FIRST** ask for input from your referring general dentists regarding the following? *Please check only **ONE** answer.*

	At the beginning	In the middle	At the end	I do not ask for input
When you treat patients with malformed teeth?	□	□	□	□
When you treat patients with missing teeth?	□	□	□	□
When you are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□

11) If applicable, at what point(s) during orthodontic treatment do you ask for input from your referring general dentists regarding the following? *Please check **ALL** that apply.*

	At the beginning	In the middle	At the end	I do not ask for input
When you treat patients with malformed teeth?	□	□	□	□
When you treat patients with missing teeth?	□	□	□	□
When you are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□

Comments: _____

_____

_____

_____

Figure A2. Survey sent to general dentists

Evaluation of the communication between orthodontists and general dentists

VIRGINIA COMMONWEALTH UNIVERSITY

Thank you for taking time to complete this survey. The survey will take less than five minutes to complete and your participation is completely voluntary.

The purposes of this study are (1) to examine how orthodontists communicate with general dentists and (2) to compare orthodontists' perception of communication with that of general dentists.

While we understand that your level and frequency of communication may differ with each orthodontist, please answer the questions based on your average experiences.

There will be no identifying information to link you to your responses and no one will know that you took this survey. Your answers will be compiled and used for a research project that will be presented at professional meetings and used in publications.

When you have finished the survey, please place it in the enclosed pre-stamped envelope and mail it at your earliest convenience.

If you have any questions, complaints, or concerns about the research, please contact:

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1) Age: _____
2) Gender: _____
3) Number of years in practice: _____
4) What type of environment do you practice in?
   □ Rural □ Suburban □ Urban
5) What type of practice do you work in?
   □ Solo practice □ Group practice □ Academic □ Military

6) Please answer the following questions about how your orthodontists communicate with you regarding the average/traditional orthodontic treatment and more complex orthodontic treatment (ie, malformed or missing teeth, implant placement, etc) of your patients.

	Average/Traditional Treatment	More Complex Treatment
How do the orthodontists communicate with you? *Please check **ALL** that apply.*	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____
How would you prefer the orthodontists communicate with you? *Please check **ONE**.*	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____	□ Phone □ Email □ Fax □ In-person □ Letter □ Use of mobile device App □ Other: _____
During treatment, at what point(s) do you receive communication? *Please check **ONE**.*	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when I ask	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when I ask
During treatment, at what point(s) would you prefer to receive communication? *Please check **ONE**.*	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when I ask	□ Only at the beginning □ Only at the end □ At the beginning and end □ Periodically (including beginning and end) □ Only when I ask

7) What percentage of the time do your orthodontists notify you when they want teeth extracted for orthodontic reasons?

□ 0% □ 1-25% □ 26-50% □ 51-75% □ 76-99% □ 100%

8) How adequately do your orthodontists communicate with you regarding the following?

	Inadequately	Adequately	Excessively
A patient's poor oral hygiene?	□	□	□
Developing white spot lesions?	□	□	□

9) What percentage of the time do your orthodontists ask for your input regarding the following?

	0%	1 - 25%	26 - 50%	51 - 75%	76 - 99%	100%
When they treat patients with malformed teeth?	□	□	□	□	□	□
When they treat patients with missing teeth?	□	□	□	□	□	□
When they are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□	□	□
When they are nearing the end of orthodontic treatment and cannot obtain ideal results?	□	□	□	□	□	□
When they are nearing the end of orthodontic treatment and can obtain ideal results?	□	□	□	□	□	□

10) If applicable, at what point during treatment do your orthodontists **FIRST** ask for your input regarding the following? *Please check only **ONE** answer.*

	At the beginning	In the middle	At the end	They do not ask for input
When they treat patients with malformed teeth?	□	□	□	□
When they treat patients with missing teeth?	□	□	□	□
When they are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□

11) If applicable, at what point(s) during treatment do your orthodontists ask for your input regarding the following? *Please check **ALL** that apply.*

	At the beginning	In the middle	At the end	They do not ask for input
When they treat patients with malformed teeth?	□	□	□	□
When they treat patients with missing teeth?	□	□	□	□
When they are determining the goals of treatment with regard to occlusion (ie, canine vs. group guidance, Class I vs. Class II or III camouflage classification, etc.)?	□	□	□	□

Comments: _____

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Vita

Kevin Bibona was born on May 11, 1981 to Salvatore and Kathleen Bibona of Chatham, New Jersey. He graduated from Chatham High School in 1999 and went on to receive a Bachelor of Science degree with Special Attainments in Commerce in Business Administration from Washington and Lee University in Lexington, Virginia. Following his undergraduate studies, he worked in finance in New York City for two years. Deciding he instead wanted to become an orthodontist, he completed a post-baccalaureate program and attended the Virginia Commonwealth University School of Dentistry, from which he graduated in 2012. He was accepted into the graduate orthodontic program at the Virginia Commonwealth University and received a Certificate of Orthodontics and a Master of Science in Dentistry degree in 2014. Upon graduation, he will enter private practice as an orthodontist in Richmond, Virginia.