

Assessment and Maintenance of Dental Implants: Clinical and Knowledge-Seeking Practices of Dental Hygienists

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Introduction

Dental implants have become the treatment of choice for replacing missing teeth, and the frequency of placement has rapidly increased since the mid-1960s.¹ Varying results have been reported in studies related to assessing dental implants, identifying signs of failure, planning continued care, implementing treatment and evaluating outcomes.²⁻⁵ Researchers have expounded on various protocols for the assessment of dental implants, which include obtaining radiographs and assessing periodontal health (probing depths, mobility, bleeding on probing and inflammation).^{6,7} After systematic reviews of randomized controlled trials, Faggion et al developed an evidence-based algorithm for the treatment of peri-implantitis.⁴

It is widely known that bleeding on probing is an indicator of inflammation of soft tissue whether around natural teeth or implants. However, there is controversy regarding the frequency of probing around dental implants due to risk of damaging delicate peri-implant tissues.⁵ Another concern is introducing bacteria into peri-implant tissues from surrounding teeth for which Terraciano suggests avoiding cross contamination by probing and scaling dental implants first.² Overall, researchers agree that gentle probing is an important part of the implant recall.^{2,5,7,8}

Abstract

Purpose: This study surveyed dental hygienists in order to assess their routine approach for dental implant maintenance and to determine if a relationship exists between the formal education of dental hygienists and their previous attendance and interest in future implant related continuing education courses.

Methods A survey was distributed to dental hygienists attending an annual national continuing education course. Participants voluntarily completed and submitted their survey before the end of the first day of the 3 day course.

Results: The results indicate that there is a statistically significant relationship between the level of formal education and implant related continuing education course attendance. Dental hygienists whose formal education did not include dental implant care were more likely to attend implant related continuing education courses than those whose formal education included this content. The majority of the dental hygienists expressed interest in continuing education courses on dental implants. Results of chi-square analysis show a statistically significant relationship between the type of education and interest in attending implant related continuing education courses. There was no statistically significant difference in continuing education interest between dental hygienists whose formal education did or did not include dental implants.

Conclusion: Additional continuing education courses have been completed by most dental hygienists whose curricula did not include formal training on dental implant care. Most dental hygienists are interested in gaining additional knowledge whether or not their dental hygiene curriculum contained content on dental implants.

Keywords: Dental implants, dental hygienists, oral examination, instrumentation, dental continuing education

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The use of plastic probes is recommended to produce less damage to the implant surface and to provide more flexibility when positioning it parallel to the long axis of the abutment.^{2,9} For the most

gentle probing around dental implants, a plastic controlled-force probe is recommended.¹⁰

Heitz-Mayfield described best practices for detecting implant failure using mobility tests and radiographic findings.¹¹ Radiographs are deemed an integral component of implant maintenance and the most important assessment tool for evaluating implant status.^{6,12} The literature varies as to the recommended interval for taking radiographs. Recommended maintenance protocols distinguish necessary care during and after the first year of implant placement. A few of the various protocols suggested are:

- Initial placement: 6 months, 12 months and every 2 years^{12,13}
- Initial placement: 1, 3 and 5 years if no pathology present⁵
- Initial placement: 6 and 12 months, annually if no pathology present – if pathology present, every 6 months until resolution¹⁴

Panoramic radiographs are most valuable when determining potential implant candidates.² Radiographs can be used to determine bone loss over time, to identify areas of radiolucency that could indicate implant failure, and to confirm adequate seating of the abutment or prosthesis.^{2,5,8,9,11,12} Periapical radiographs using the paralleling technique have been recommended to assess bone loss and implant components.⁵ When evaluating dental implants after placement, panoramic radiographs are considered helpful tools by some while others question their value.^{5,13}

The dental hygiene appointment may include debridement of hard and soft deposits using hand and power instruments designed specifically to protect the delicate implant surface. Recare intervals of 3, 4 or 6 months are recommended for careful evaluation of peri-implant tissues by the dental hygienist and dentist.⁸

Persson pointed out that it is likely that the instruments available for debridement around implants are not properly designed to reach affected areas.³ This limitation is mentioned because implant design, location and clinical conditions make it difficult to provide adequate debridement of dental implants. While searching for ideal implant tools, researchers have studied the effect of several debridement instruments on implant surfaces. Summaries of their findings include:

- Titanium hand instruments versus ultrasonic scalers: no group differences were found in the treatment outcomes. Plaque and bleeding

scores improved in both groups, with no effects on probing depths¹⁵

- Resin tipped scalers versus gold coated or graphite instruments: resin tipped scalers do not create scratches and performed better than gold coated/graphite instruments¹⁶
- Plastic scalers versus ultrasonic device: plastic scalers produced less alteration of titanium surfaces than ultrasonic device¹⁷
- Curettes versus ultrasonic device: no group differences in the ability to reduce the microbiota in peri-implantitis³
- Ultrasonic scalers covered with a plastic sheath and Ultrasonic scalers with carbon tips versus metal scalers: carbon and plastic tipped ultrasonics produced smooth implant surfaces while metal tips resulted in damaged implant surfaces¹⁸

Dental hygienists are routinely responsible for the continuity of patient education and maintenance of dental implants, years beyond initial placement. This care is referred to as the “first line” therapy or the nonsurgical approach.⁴ However, there is a paucity of evidence based research regarding the best practices for implant maintenance, specifically by the dental hygienist. Graduates prior to the late 1990s may have had little to no formal education on implant care, yet they are treating patients with dental implants. Dentists are encouraged to actively seek standardized and comprehensive training via professional-centered education.⁴ Professional continuing education may similarly fulfill this need for dental hygienists.

In this current study, authors surveyed dental hygienists from diverse educational and practice backgrounds in order to assess their routine approach for dental implant maintenance. This study also sought to determine if a relationship exists between the formal education of dental hygienists and their previous attendance and interest in future continuing education courses about implants.

Methods and Materials

After an extensive review of the literature, faculty at the Medical College of Georgia Department of Dental Hygiene developed a 24-item paper survey specifically for this study. All items on the survey reflected content found in publications that addressed maintenance of dental implants. Only the faculty considered the questions and content validity of the survey. The protocol for this study was submitted to the institution’s Human Assurance Committee. Upon review of the proposal, it was determined that this study was not considered human subjects research as defined by the federal regulations because the data obtained was restrict-

ed to assessing the practices of dental hygienists.

Upon arrival to an annual national continuing education course, the instrument Dental Hygiene Care of Implants–Survey of Dental Hygienists was distributed to all attendees (n=370). All course attendees were female and the states they represented are shown in Table I. Participants were conveniently sampled and volunteered to submit their survey before the end of the first day of the 3 day course. Surveys submitted after the first day of the symposium were not included in this study because lectures on implant maintenance were scheduled for the second day. Completed surveys were returned to the continuing education staff members before the data collection deadline. Data were entered in a spreadsheet by 1 author and then independently verified by another author to ensure accuracy.

Results

Survey response rate was 57.5% (n=213). Most dental hygienists (n=170, 80%) reported employment in a general practice setting, followed by 7% (n=14) in periodontal practice. The remaining 13% (n=27) reported working in other settings which included pediatric, endodontic and government entities. One hundred and five (49%) reported that they have practiced for over 15 years, while 38 (18%) have practiced 11 to 15 years and 66 (31%) have practiced 10 years or less.

Table II details dental implant training, history of continuing education and interest of the participants in future continuing education courses on dental implants. Half of the participants reported that they received formal training on dental implants during their dental hygiene education and about half reported that they did not receive such training. A chi-square test was used to determine if there is a relationship between the type of education (formal education versus no formal education) and continuing education course attendance (attended course versus did not attend course). The results indicate that there is a statistically significant relationship between the type of education and continuing education course attendance (chi-square with 1 degree of freedom=5.435, p=0.019). Dental hygienists whose formal education did not include dental implant care were more likely to attend continuing education courses than those whose formal education included this content. There was no statistically significant difference in continuing education interest between dental hygienists whose formal education did or did not include dental implants (chi-square with 1 degree of freedom=0.021,

Table I: States Where Participants Practice Dental Hygiene

State	Number	%
GA	277	75
SC	43	12
NC	19	5.1
FL	17	4.6
VA	2	0.5
KY	2	0.5
MD	1	0.3
NJ	1	0.3
TN	6	1.6
OH	1	0.3
IL	1	0.3
Total	370	100

Table II: Dental Implant Training and Continuing Education

	n	%
Received training in classroom and clinic on implant care while attending dental hygiene school	25	12
Did not receive any training on implant care while attending dental hygiene school	108	51
Attended one or more continuing education courses on implant maintenance	111	52
Has not attended continuing education courses on implant maintenance	100	47
Interested in a continuing education course to strengthen background in maintenance of dental implants	198	93
Not interested in a continuing education course to strengthen background in maintenance of dental implants	12	5.6

p=0.88). Most dental hygienists (n=199, 93.9%) expressed interest in continuing education courses on dental implants.

A summary of the survey responses regarding procedures for dental implant maintenance is shown in Tables III through VII. Table III summarizes responses regarding the clinical assessment of dental implants. Over 90% (n=193 to 198) of participants reported that they evaluate plaque/calculus deposits, exudate/bleeding, mobility and inflammation. Fewer (n=67, 31%) evaluate the presence of salivary percolation around the margin of crowns covering implants. The major-

Table III: Clinical Assessment of Dental Implants

	n	%
Evaluates amount of adjacent keratinized tissue	104	49
Evaluates color of adjacent gingival tissue (inflammation present)	193	91
Evaluates presence of stippling/tissue consistency	133	62
Evaluates presence of exudate/bleeding	196	92
Evaluates presence of deposits (plaque and/or calculus)	198	93
Evaluates presence of salivary percolation when slight pressure is applied to the crown of an implant	67	31
Evaluates mobility	195	92
Evaluates occlusion	113	53
Evaluates parafunctional habits (grinding, abrasion)	121	57
Evaluates recession	173	81
Probes around implants	162	76
Does not probe around implants	39	18
Uses plastic probe	149	70
Uses metal probe	17	8
Uses pressure-sensitive plastic probe	9	4.2
Uses automated probe	0	0
Records the presence of bleeding on probing around the implant	153	72
Does not record the presence of bleeding on probing around the implant	14	6.6
Establishes a fixed reference point such as the margin of a crown to use during probing	98	46
Does not establish a fixed reference point such as the margin of a crown to use during probing	65	31

Table IV: Radiographic Assessment of Dental Implants

	n	%
Takes radiographs of an implant once a year	117	55
Takes radiographs of an implant every 6 months	28	13
Takes radiographs of an implant every 3 months during the 1st year and every 6 months thereafter	12	5.6
Takes radiographs of an implant every 3 months during the 1st year and annually thereafter	20	9.4
Takes radiographs of an implant at a different established interval	9	4.2
Takes radiographs of an implant at no set interval	32	15
Uses other intervals for scheduling implant patients for maintenance after the first year of completion	12	5.6
Routinely takes periapical radiographs of implants	147	69
Routinely takes vertical bitewing radiographs of implants	48	23
Routinely takes horizontal bitewing radiographs of implants	50	23
Routinely takes panoramic radiographs of implants	31	15
Does not routinely take radiographs of implants	12	5.6
Checks bone level surrounding the implant on a regular basis at maintenance appointments	178	84
Does not check bone level surrounding the implant on a regular basis at maintenance appointments	27	13

ity of respondents probe around dental implants (n=162, 76%) and use a plastic probe (n=149, 70%). In Table IV, over half (n=117, 55%) take radiographs of dental implants at least once per year, and 69% (n=147) reported periapicals as the most common type of radiograph taken.

In Table V, dental hygienists most commonly reported that they perform both supragingival and subgingival instrumentation around dental implants (n=164, 77%). Most (n=190, 89%) use plastic scalers during debridement, while a few (n=16, 7.5%) use stainless steel scalers on dental implants. As shown in Table VI, most dental

hygienists (n=151, 71%) do not dip the probe in an antimicrobial agent prior to using it to evaluate dental implants. Almost half (n=97, 45.5%) administered a microbial rinse and half do not (n=107, 50%).

Maintenance intervals for patients with dental implants are reported in Table VII. Most respondents (n=166, 77%) indicated that they schedule patients every 3, 4 or 6 months during the first year after completion of the dental implant. Forty percent (n=86) reported that, after the first year of placement, maintenance intervals are primarily based on individual need.

Discussion

The date of graduation from their dental hygiene program may explain why over half of the participants in this study did not receive formal training on dental implant maintenance. Dental implants may not have been part of their curriculum. Humphrey notes that dental implants have now become an integral part of dental reconstruction and quotes that approximately 300,000 to 428,000 dental implants are placed annually in the U.S.⁵ Accordingly, it is imperative that dental hygienists have the most current knowledge for the maintenance of dental implants.

The majority of participants surveyed in this study follow the recommendations of Kurtzman during visual inspection of tissues surrounding dental implants, noting color, texture, amount of biofilm and calculus, probing depths, bleeding, mobility and recession.⁸ Most reported they probe dental implants. Although probing causes a separation between the surface of the implant and the junctional epithelium, it is still deemed an indispensable part of implant maintenance.⁷

About 5% (n=11) reported they dip the probe in an antimicrobial rinse prior to use on dental implants to avoid cross-contamination. However, there has not been any substantial evidence to validate the effectiveness of this approach. Fifty percent (n=107) reported use of an antimicrobial rinse as part of their implant care protocol, although current evidence does not show a significant difference between debridement alone and debridement with antimicrobials.^{19,20} The frequency of taking radiographs varied amongst participants in this study, which is consistent with the variety of protocols suggested in the literature.^{5,12-14}

Table V: Implementation of Dental Hygiene Care Plan

	n	%
Has an established protocol in office for home care instructions for implant patients	130	61
Does not have an established protocol in office for home care instructions for implant patients	75	35
Performs supragingival instrumentation around implants	39	18
Performs subgingival instrumentation around implants	7	3.3
Performs both supragingival and subgingival instrumentation around implants	164	77
Uses stainless steel scalers during debridement around implants	16	7.5
Uses plastic scalers during debridement around implants	190	89
Uses graphite scalers during debridement around implants	26	12
Uses teflon coated scalers during debridement around implants	22	10
Uses gold-tipped scalers during debridement around implants	8	3.8
Uses ultrasonic scalers with standard inserts during debridement around implants	13	6.1
Uses ultrasonic scalers with specific implants during debridement around implants	25	12
Uses other type of instruments during debridement around implants	10	4.7
Uses fine prophy paste for polishing the implant/crown	80	38
Uses medium prophy paste for polishing the implant/crown	44	21
Uses tin oxide for polishing the implant/crown	7	3.3
Uses air polisher for polishing the implant/crown	40	19
Uses toothpaste for polishing the implant/crown	25	12
Uses prophy paste designed for implants for polishing the implant/crown	17	8
Uses other agents for polishing the implant/crown	16	7.5
Polishes the implant post if it is visible	91	43
Does not polish the implant post if it is visible	105	49

In this study, most dental hygienists used plastic scalers as recommended in the literature.^{2,9,10} However, a few participants reported that they use metal scalers and ultrasonic scalers with standard inserts. Periodic evaluation of the dental implant is critical to the health of peri-implant tissues. Participants in this study indicated they follow the traditional 3 to 6 month re-care interval. This finding correlates with the recommended 3 month re-care intervals during the first year after implant placement and continuous supervision of the patient with implants.^{5,9} There is a paucity of refereed evidence based research that specifically addresses the care of implants by the dental hygienist. Accordingly, Hultin suggests that there is a need for such studies to be initiated.²¹

Results of this study cannot be generalized to

the entire population of dental hygienists due to the limitations of using a convenience sample. Further studies should include a sample that is representative of the 130,000 active dental hygienists in the U.S.²² The popularity of dental implants will continue to increase with the aging population who will demand more esthetic care. Thus, dental hygienists will continue to be the first line of therapy in maintaining healthy peri-implant tissues.

Conclusion

This study provided a descriptive summary of knowledge-seeking practices and clinical approaches used by dental hygienists in the maintenance of dental implants. Over half of the participants in this study did not have formal training on dental implants during their dental hygiene education, but have taken continuing education courses. Regardless of whether they had formal training or not, most dental hygienists are interested in gaining additional knowledge regarding dental implants.

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Table VI: Use of Antimicrobials

	n	%
Dips the probe in an antimicrobial rinse prior to use on implants	11	5.2
Does not dip the probe in an antimicrobial rinse prior to use on implants	151	71
Uses an antimicrobial rinse as part of implant care protocol	97	45.5
Does not use an antimicrobial rinse as part of implant care protocol	107	50
Uses chlorhexidine antimicrobial rinse as part of implant care protocol	83	39
Uses essential oils antimicrobial rinse as part of implant care protocol	43	20
Uses cetylpyridinium chloride antimicrobial rinse as part of implant care protocol	15	7
Uses other antimicrobial rinse as part of implant care protocol	7	3
Uses antimicrobial as pre-rinse	60	28
Uses antimicrobial as oral irrigation	49	23
Uses antimicrobial as a dip for floss/gauze	11	5
Uses antimicrobial as a dip for the probe	8	4

Table VII: Maintenance Intervals

	n	%
Schedules implant patients for maintenance once during the first year after placement	1	0.5
Schedules implant patients for maintenance every 3 months during the first year after placement	73	34
Schedules implant patients for maintenance once every 4 months during the first year after placement	22	10
Schedules implant patients for maintenance once every 6 months during the first year after placement	71	33
No established policy for scheduling implant patients for maintenance during the first year	37	17
Uses other intervals for scheduling implant patients for maintenance during the first year	14	6.6
Schedules implant patients annually for maintenance after the first year of completion	6	2.8
Schedules implant patients every 3 months for maintenance after the first year of completion	31	15
Schedules implant patients every 6 months for maintenance after the first year of completion	80	38
Schedules implant patients based on individual need for maintenance after the first year of completion	86	40

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