Clinical Practice Guidelines for Recall and Maintenance of Patients with Tooth-Borne and Implant-Borne Dental Restorations

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Abstract

Purpose: To provide guidelines for patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth- and implant-borne removable and fixed restorations.

Methods: The American College of Prosthodontists (ACP) convened a scientific panel of experts appointed by the ACP, American Dental Association (ADA), Academy of General Dentistry (AGD), and American Dental Hygienists Association (ADHA) who critically evaluated and debated recently published findings from 2 systematic reviews on this topic. The major outcomes and consequences considered during formulation of the clinical practice guidelines (CPGs) were risk for failure of tooth- and implant-borne restorations. The panel conducted a round table discussion of the proposed guidelines, which were debated in detail. Feedback was used to supplement and refine the proposed guidelines, and consensus was attained.

Results: A set of CPGs was developed for tooth-borne restorations and implant-borne restorations. Each CPG comprised of 1) patient recall; 2) professional maintenance, and 3) at-home maintenance. For tooth-borne restorations, the professional maintenance and at-home maintenance CPGs were subdivided for removable and fixed restorations. For implant-borne restorations, the professional maintenance CPGs were subdivided for removable and fixed restorations and further divided into biological maintenance and mechanical maintenance for each type of restoration. The at-home maintenance CPGs were subdivided for removable and fixed restorations.

Conclusion: The clinical practice guidelines presented in this document were initially developed using the 2 systematic reviews. Additional guidelines were developed using expert opinion and consensus, which included discussion of the best clinical practices, clinical feasibility and risk-benefit ratio to the patient. To the authors' knowledge, these are the first CPGs addressing patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth-borne and implant-borne restorations. This document serves as a baseline with the expectation of future modifications when additional evidence becomes available.

Keywords: clinical practice guidelines, tooth-borne, implant-borne, patient recall, maintenance

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Introduction

Clinical practice guidelines (CPG) are intended to provide clinicians with guidance in diagnosis, treatment planning, and clinical decision-making.[1] CPGs have been shown to improve patient care processes and clinical outcomes, and to better identify and limit treatment risks.[1-4] Although empirically developed CPGs have been used in medicine for hundreds of years, in the 1990s systematic approaches were advanced and advocated for CPGs. In an extensive systematic review of 59 published CPGs in medicine, Grimshaw and Russell[4] showed that explicit CPGs improved clinical practice when introduced in the context of rigorous evaluations. In dentistry, a few oft-cited CPGs include the use of antibiotic prophylaxis before dental procedures to prevent endocarditis in certain cardiac patients,[5] the use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints,[6] antibiotic prophylaxis for dental patients at risk for infection,[7] oral health care for the pregnant ado-

lescent,[8] guidelines for the care and maintenance of complete dentures,[9] management of patients with medication-related osteonecrosis of the jaws (MRONJ)[10] and many others.[11] The United States maintains a national registry in the National Guideline Clearinghouse for evidence-based clinical practice guidelines, which are submitted and endorsed by various medical and professional organizations.[11] It is important to note that unlike traditional CPGs based on empiricism or medical authority, modern CPGs involve a systematic and transparent process for scrutiny of scientific evidence, and recommendations are made with the intent that they will be updated and modified as scientific evidence becomes available.[1-4] Despite this, recommendations made in CPGs are not always supported by scientific evidence. This is because many empirical procedures and treatments that yield favorable outcomes do not necessarily have scientific evidence at the present time.[12]

Patients seeking prosthodontic care often present with significant previous dental treatment, a complex etiology of factors contributing to the loss of teeth, loss of tooth structure, and equally complex treatment needs to restore function and esthetics. Treatment plans to address patient needs using tooth- or implant-borne restorations require careful diagnosis, risk assessment, treatment planning, meticulous execution of care, and a long-term partnership with the patient and treatment team to maintain an enduring result. Given the resources required to treat patients with complex dental needs, an appropriate patient recall regimen, professional maintenance regimen, and at-home maintenance regimen are paramount for long-term success.[13,14] Furthermore, it is likely that the professional and at-home maintenance protocols in healthy adult patients with tooth- and implant-borne restorations may be significantly different when compared to patients with no restorations, or patients with acute or chronic oral and systemic diseases. For tooth-borne restorations, guidelines on the options and relative merits of professional and at-home maintenance protocols to predictably achieve stable results are lacking.[13] Current guidelines for the maintenance of implant restorations are poorly defined and often based on empiricism or traditional protocols for patients with natural dentition rather than what is most suitable for maintenance of implant restorations and supporting tissues.[14] Therefore, professional and at-home maintenance guidelines are necessary for patients with tooth- and implant-borne removable and fixed restorations to improve the health of supporting tissues, limit disease processes such as caries, periodontitis, or peri-implant disease, and improve the expected longevity of restorations as well as the supporting teeth and implants themselves. Guidelines are needed to provide direction for the dental health care provider with the goal of improved clinical outcomes for the patient.

Patients with complex tooth- and implant-borne restorations require a lifelong professional recall regimen to provide biological and mechanical maintenance customized for each patient. Therefore, the purpose of this CPG document is to provide: 1) guidelines for patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth-borne restorations and 2) guidelines for patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with implant-borne restorations. The target populations of this CPG are patients with tooth- and implant-borne removable and fixed restorations. The intended users of the presented CPGs are: general dentists, dental hygienists, prosthodontists and other dental specialists, dental health care providers, allied health personnel, nurses, social workers, students, patients, medical and dental insurance carriers, and public health departments.

Methods and Materials

To the authors' knowledge, this is the first CPG addressing patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth- and implant-borne restorations and serves as a baseline for future modifications and versions based on future scientific evidence. Two separate systematic reviews of the literature were conducted to evaluate the recall and maintenance regimens for tooth- and implant-borne restorations.[13,14] The systematic review on tooth-borne restorations included articles published from January 1, 1999 to December 31, 2014. The systematic review on implant-borne restorations included articles published from January 1, 2004 to December 31, 2014. The detailed methodology for the search processes are described in the respective systematic review articles.[13,14] For tooth-borne restorations, 16 studies were identified in the systematic review that reported data on a combined 3569 patients. Of these, nine were randomized controlled clinical trials (RCT), and seven were observational studies. For implant-borne restorations, 20 studies were identified, reporting on 1088 patients. Of these, eleven were RCTs, and nine were observational studies. Results from all of these studies were scrutinized, tabulated, and analyzed to formulate conclusions and then create the CPGs.

A scientific panel comprised of experts appointed by the American College of Prosthodontists (ACP), American Dental Association (ADA), Academy of General Dentistry (AGD), and American Dental Hygienists Association (ADHA) critically evaluat-

ed and debated the published evidence from two systematic reviews on this topic. A rating scheme for strength of recommendation as described by Shekelle et al[1] was used as it was most applicable to this topic and is widely used and validated in the medical literature (Tables I, II). The major outcomes and consequences considered during formulation of these CPGs were: 1) risk for failure of tooth-borne restorations and 2) risk for failure of implant-borne restorations. Thereafter, the members of the task force conducted a roundtable peer review/evaluation discussion of the proposed guidelines, and the guidelines were debated in detail. These inputs were used to supplement and refine the proposed guidelines, and consensus was attained for the various guidelines presented.

Results

Patients with tooth- and implant-borne restorations require a lifelong professional recall regimen to provide biological and mechanical maintenance, customized for each patient. Therefore, a set of CPGs was created for each type of restoration comprising: 1) patient recall; 2) professional maintenance, and 3) at-home maintenance. The CPGs are presented in Table III for tooth-borne restorations[15-30] and Table IV for implant-borne restorations.[31-50] For tooth-borne restorations, the professional maintenance and at-home maintenance CPGs were subdivided for removable and fixed restorations. For implant-borne restorations, the professional maintenance CPGs were sub-divided for removable and fixed restorations and further divided into biological maintenance and mechanical maintenance for each type of restoration. The at-home maintenance CPGs were subdivided for removable and fixed restorations. The strength of evidence and subsequent recommendation that is presently available was applied for each guideline. When a guideline comprised multiple aspects, then multiple strengths of available recommendations in descending order were applied. Additionally, when multiple strengths of recommendation were available for a specific guideline, they were all applied accordingly.

Table I: Levels and Category of Evidence as Described by Shekelle et al[1]

Level	Category of Evidence
Ia	Evidence from systematic review of randomized controlled trials
Ib	Evidence from at least one randomized controlled trial
IIa	Evidence from at least one controlled study without randomization
IIb	Evidence from at least one other type of quasi-experimental study, such as time series analysis or studies in which the unit of analysis is not the individual
III	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies, cohort studies, and case- control studies
IV	Evidence from expert committee reports or opinions or clinical experience of respected authorities or both

Table II: Rating Scheme for the Strength of Recommendation as Described by Shekelle et al[1]

Classification	Strength of recommendation
A	Directly based on category I evidence
B	Directly based on category II evidence or extrapolated from category I evidence
C	Directly based on category III evidence or extrapolated from category I or II evidence
D	Directly based on category IV evidence or extrapolated from category I, II, or III evidence

Discussion

The scientific panel considered the potential benefits, harms, contraindications, and scope of these guidelines. The potential benefits for these guidelines include: 1) improved oral health and longevity of natural teeth, tooth-borne, and implant-borne restorations and 2) improved oral health related quality of life. The potential harms considered were 1) increased short-term cost to patients to adhere to recall regimen, professional maintenance regimen, and at-home maintenance regimen and 2) adverse effects related to any of the professionally used oral topical agents or at-home oral topical agents and oral hygiene aids. The contraindications to these guidelines include allergies or adverse effects related to any of the professionally used oral topical agents or at-home oral topical agents.

A potential source of bias considered during development of the CPGs was that authors of the systematic reviews also served as panel members for the CPG.[51,52] To minimize this potential bias, efforts were made during the scientific panel meetings to debate and justify each guideline in an open and transparent format. Financial and organizational conflicts of interests were not identified. Strength of evidence was debated for every guideline. Thus, the effect of "groupthink" may not be a source of

Table III: Clinical Practice Guidelines for Recall and Maintenance of Patients with Tooth-Borne Dental Restorations

Number	Topic	Guideline	Strength of Recommendation
1.	Patient recall	Patients with tooth-borne restorations (fixed or removable) should be advised to obtain a dental professional examination at least every 6 months as a lifelong regimen.	D
		Patients categorized by the dentist as higher risk based on age, ability to perform oral self care, biological or mechanical complications of natural teeth or tooth-borne restorations should be advised to obtain a dental professional examination more often than every 6 months, depending upon the clinical situation.	D
2A.	Professional maintenance: Tooth-borne removable restorations (partial removable dental prostheses)	Professional maintenance for patients with tooth-borne removable restorations should include an extraoral and intraoral health and dental examination, oral hygiene instructions for existing natural teeth and any restorations, oral hygiene intervention (cleaning of natural teeth and restorations), and use of oral topical agents as deemed clinically necessary.	A, C, D
		Professional maintenance of the partial removable dental prostheses should include hygiene instructions, detailed examination of the prosthesis, prosthetic components and patient education about any foreseeable problems that could impair optimal function with the restoration. The partial removable dental prosthesis should be professionally cleaned extraorally using professionally accepted mechanical and chemical methods.	D
		Professionals should recommend and/or prescribe appropriate oral topical agents and oral hygiene aids suitable for the patient's at-home maintenance needs.	D
2B.	Professional maintenance: Tooth-borne fixed restorations (intracoronal restorations, extracoronal restorations, veneers, single crowns, and partial fixed dental prostheses)	Professional maintenance for patients with tooth-borne fixed restorations should include an extraoral and intraoral health and dental examination, oral hygiene instructions for natural teeth and the fixed restorations, oral hygiene intervention (cleaning of natural teeth and restorations), and use of oral topical agents as deemed clinically necessary.	A, C, D
		Professionals should recommend and/or prescribe appropriate oral topical agents and oral hygiene aids suitable for the patient's at-home maintenance needs.	D
		When clinical signs indicate the need for an occlusal device, professionals should educate the patient and fabricate an occlusal device to protect the tooth-borne fixed restorations.	D
		Professional maintenance of the occlusal device should include hygiene instructions, detailed examination of the occlusal device, and patient education about any foreseeable problems that could impair optimal function with the occlusal device. The occlusal device should be professionally cleaned extraorally, using professionally accepted mechanical and chemical methods.	D

Note: Guidelines 2A, 2B, 3A and 3B are supported by references 15 through 30

bias in this baseline CPG document. Conversely, having the same author group to draft the CPGs may be viewed as a strength of this document, due to the profound insight obtained by the author group during the systematic review process.

Most of the guidelines in this document are graded as category D for strength of recommendation, but it is anticipated that the strength of recommendation would be higher in the future. Using Shekelle's method[1] for grading the strength of recommendation allowed incorporation and delineation of various types of evidence, including expert opinion/consensus, into four categories, while formulating these guidelines. Additionally, it allowed extrapolation of higher categories of evidence to lower categories and provided more freedom in designation of an article to a specific category. The authors considered other widely popular alternatives such as Grading of Recommendations Assessment, Development and Evaluation (GRADE) method,[53] and the Strength of Recommendation Taxonomy (SORT) method.[54] However, these alternatives were less applicable to the topic of this baseline CPG. The GRADE method divides the expression of evidence into only two categories, weak

Table III: Clinical Practice Guidelines for Recall and Maintenance of Patients with Tooth-Borne Dental Restorations (continued)

Number	Topic	Guideline	Strength of Recommendation
3A.	At-home maintenance: Tooth-borne removable restorations (partial removable dental prostheses)	Patients with tooth-borne removable restorations should be educated about brushing existing natural teeth and restorations twice daily, and the use of oral hygiene aids such as dental floss, water flossers, air flossers, interdental cleaners, and electric toothbrushes.	C, D
		Patients with tooth-borne removable restorations should be educated about cleaning their prosthesis at least twice daily using a soft brush and the professional recommended denture-cleaning agent.	D
		Patients with multiple and complex restorations on existing teeth supporting or surrounding the removable restoration should be advised to use oral topical agents such as toothpaste containing 5000 ppm fluoride or toothpaste with 0.3% triclosan, and to add supplemental short-term use of chlorhexidine gluconate when indicated.	A, C, D
		Patients with tooth-borne removable restorations should be advised to remove the restoration out of the mouth during sleep. The removed prosthesis should be stored in a prescribed cleaning solution.	D
3B.	At-home maintenance: Tooth-borne fixed restorations (intracoronal restorations, extracoronal restorations, veneers, single crowns, and partial fixed dental prostheses)	Patients with tooth-borne fixed restorations should be educated about brushing twice daily, and the use of oral hygiene aids such as dental floss, water flossers, air flossers, interdental cleaners, and electric toothbrushes.	A, D
		Patients with multiple and complex restorations on existing teeth should be advised to use oral topical agents such as toothpaste containing 5000 ppm fluoride or toothpaste with 0.3% triclosan, and to add supplemental short-term use of chlorhexidine gluconate when indicated.	A, C, D
		Patients prescribed with occlusal devices should be advised to wear the occlusal device during sleep.	D
		Patients prescribed with occlusal devices should be educated about cleaning their occlusal device before and after use, with a soft brush and the prescribed cleaning agent. Patients should also be educated about proper methods for storage of the occlusal device when not in use.	D

Note: Guidelines 2A, 2B, 3A and 3B are supported by references 15 through 30

or strong, which was not appropriate for this baseline CPG.[53] The SORT method divides the strength of recommendation into three categories (A, B and C) but does not allow extrapolation of higher categories of evidence to lower categories.[54]

This document is intended for healthy adult patients with tooth- or implant-borne restorations. Management of patients with mixed restorations (tooth- and implant-borne removable or fixed restorations) in one or both jaws should encompass both sets of proposed guidelines, appropriate to the clinical situation. Management of patients with conditions such as bruxism, xerostomia, periodontal disease, peri-implant disease, or other conditions are outside the scope of these CPGs; however, the recall and maintenance regimen guidelines made in this document would likely be helpful to these patients. This baseline document is intended to improve patient care protocols, but is not intended as a standard of care. The outlined CPGs should be supplemented with professional judgment and consideration of the unique needs and preferences of each patient.

Conclusion

This document provides clinical practice guidelines for patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth-borne and implant-borne restorations. The various guidelines were made using the best level of evidence whenever available. Guidelines made using expert opinion/consensus included the best possible analysis of best clinical practices, clinical feasibility, and risk-benefit ratio for patients. A scientific panel ap-

Table IV: Clinical Practice Guidelines for Recall and Maintenance of Patients with Implant-Borne Dental Restorations

Number	Topic	Guideline	Strength of Recommendation
1.	Patient recall	Patients with implant-borne restorations (fixed or removable) should be advised to obtain a dental professional examination visit at least every 6 months as a lifelong regimen.	D
		Patients categorized by the dentist as higher risk based on age, ability to perform oral self care, biological or mechanical complications of remaining natural teeth, tooth-borne restorations or implant-borne restorations should be advised to obtain a dental professional examination more often than every 6 months, depending upon the clinical situation.	D
2A.	Professional maintenance (Biological): Implant-borne removable restorations (implant-supported partial removable dental prostheses and implant-supported overdenture prostheses)	Professional biological maintenance for patients with implant-borne removable restorations should include an extraoral and intraoral health and dental examination, oral hygiene instructions, hygiene instructions for the prostheses and oral hygiene intervention (cleaning of any natural teeth, tooth-borne restorations, implant-borne restorations, or implant abutments).	A, C, D
		Professionals should use chlorhexidine gluconate as the oral topical agent of choice when antimicrobial effect is needed clinically.	A, C
		Professionals should use cleaning instruments compatible with the type and material of the implants, abutments and restorations, and powered instruments such as the glycine powder air polishing system.	A, C, D
		Implant-supported partial removable dental prostheses and implant-supported overdenture prostheses should be professionally cleaned extraorally using professionally accepted mechanical and chemical cleaning methods.	D
		Professionals should recommend and/or prescribe appropriate oral topical agents and oral hygiene aids suitable for the patient's at-home maintenance needs.	A, C, D
2B.	Professional maintenance (Mechanical): Implant-borne removable restorations (implant-supported partial removable dental prostheses and implant-supported overdenture prostheses)	Professional mechanical maintenance for patients with implant-borne removable restorations should include a detailed examination of the prosthesis, intra and extraoral prosthetic components, and patient education of foreseeable problems that could impair optimal function of the restoration.	C, D
		Professionals should recommend and perform adjustment, repair, replacement, or remake of any or all parts of the prosthesis and prosthetic components that could compromise function.	C, D
2C.	Professional maintenance (Biological): Implant-borne fixed restorations (implant-supported single crowns, partial fixed dental prostheses and implant-supported complete arch fixed prostheses)	Professional biological maintenance for patients with implant-borne fixed restorations should include an extraoral and intraoral health and dental examination, oral hygiene instructions, and oral hygiene intervention (cleaning of any natural teeth, tooth-borne restorations, implant-borne restorations, or implant abutments).	A, C, D
		Professionals should use chlorhexidine gluconate as the oral topical agent of choice when antimicrobial effect is needed clinically.	A, C
		Professionals should use cleaning instruments compatible with the type and material of the implants, abutments, and restorations, and powered instruments such as the glycine powder air polishing system.	A, C, D
		In patients with implant-supported fixed prostheses, the decision to remove the prosthesis for biological maintenance should be based on the patient's demonstrated inability to perform adequate oral hygiene. The prosthesis contours should be reassessed to facilitate at-home maintenance.	D
		Professionals should consider using new prosthetic screws when an implant-borne restoration is removed and replaced for professional biological maintenance.	D

Guidelines 2A, 2B, 2C, 2D, 3A and 3B are supported by references 31 through 50

Table IV: Clinical Practice Guidelines for Recall and Maintenance of Patients with Implant-Borne Dental Restorations (continued)

Number	Topic	Guideline	Strength of Recommendation
2D.	Professional maintenance (Mechanical): Implant-borne fixed restorations (implant-supported single crowns, partial fixed dental prostheses, and implant-supported complete arch fixed prostheses)	Professional mechanical maintenance for patients with implant-borne fixed restorations should include a detailed examination of the prosthesis, prosthetic components, and patient education about any foreseeable problems that could compromise function.	C, D
		Professionals should recommend and perform adjustment, repair, replacement, or remake of any or all parts of the prosthesis and prosthetic components that could impair patient's optimal function.	C, D
		Professionals should consider using new prosthetic screws when an implant-borne restoration is removed and replaced for professional mechanical maintenance.	D
		When clinical signs indicate the need for an occlusal device, professionals should educate the patient and fabricate an occlusal device to protect implant-borne fixed restorations.	D
		Professional maintenance of the occlusal device should include hygiene instructions, detailed examination of the occlusal device, and patient education about any foreseeable problems that could impair optimal function with the occlusal device. The occlusal device should be professionally cleaned extraorally using professionally accepted mechanical and chemical methods.	D
		Patients with multiple and complex restorations on existing teeth should be advised to use oral topical agents such as toothpaste containing 5000 ppm fluoride or toothpaste with 0.3% triclosan, and to add supplemental short-term use of chlorhexidine gluconate when indicated.	A, C, D
		Patients prescribed with occlusal devices should be educated to wear the occlusal device during sleep.	D
3A.	At-home maintenance: Implant-borne removable restorations (implant-supported partial removable dental prostheses, and implant-supported overdenture prostheses)	Patients with implant-supported partial removable dental prostheses should be educated about brushing existing natural teeth and restorations twice daily, and the use of oral hygiene aids such as dental floss, water flossers, air flossers, interdental cleaners, and electric toothbrushes.	C, D
		Patients with implant-borne removable restorations should be advised to clean their intraoral implant components at least twice daily, using a soft brush and the professionally recommended oral topical agent.	D
		Patients with implant-borne removable restorations should be advised to clean their prosthesis at least twice daily using a soft brush with a professional recommended denture-cleaning agent.	D
		Patients with implant-borne partial or complete removable restorations should be advised to remove the restoration while sleeping. The removed prosthesis should be stored in a prescribed cleaning solution.	D
3B.	At-home maintenance: Implant-borne fixed restorations (implant-supported single crowns, partial fixed dental prostheses and implant-supported complete arch fixed prostheses)	Patients with implant-borne fixed restorations should be educated about brushing twice daily, and the use of oral hygiene aids such as dental floss, water flossers, air flossers, interdental cleaners and electric toothbrushes.	C, D
		Patients with multiple and complex implant-borne fixed restorations, should be advised to use oral topical agents such as toothpaste containing 0.3% triclosan and to add supplemental short-term use of chlorhexidine gluconate when indicated.	A, C, D
		Patients prescribed with occlusal devices should be advised to wear the occlusal device during sleep.	D
		Patients prescribed with occlusal devices should be educated about cleaning their occlusal device before and after use, with a soft brush and the prescribed cleaning agent. Patients should also be educated about proper methods for storage of the occlusal device when not in use.	D

Guidelines 2A, 2B, 2C, 2D, 3A and 3B are supported by references 31 through 50

pointed by the American College of Prosthodontists (ACP), American Dental Association (ADA), Academy of General Dentistry (AGD), and American Dental Hygienists Association (ADHA) developed and approved the CPGs. This document serves as a baseline with the expectation of future modifications to reflect best clinical practices and when additional evidence becomes available.

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