Impression evaluation and laboratory use for single-unit crowns

Findings from The National Dental Practice-Based Research Network

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ABSTRACT

Background. Objectives were to determine the likelihood that a clinician accepts an impression for a single-unit crown and document crown remake rates.

Methods. The authors developed a questionnaire that asked dentists about techniques used to fabricate single-unit crowns. The authors showed dentists photographs of 4 impressions and asked them to accept or reject each impression. The authors correlated answers with dentist and practice characteristics. Other questions pertained to laboratory use and crown remake rates.

Results. The response rate was 83% (1,777 of 2,132 eligible dentists). Of the 4 impressions evaluated, 3 received consistent responses, with 85% agreement. One impression was more equivocal; 52% accepted the impression. The likelihood of accepting an impression was associated significantly with the clinician's sex, race, ethnicity, and practice busyness. Clinicians produced 18 crowns per month on average, and 9% used in-office milling. Most dentists (59%) reported a remake rate of less than 2%, whereas 17% reported a remake rate greater than 4%. Lower remake rates were associated significantly with more experienced clinicians, optical impressions, and not using dual-arch trays.

Conclusions. Although dentists were largely consistent in their evaluation of impressions (> 85%), nonclinical factors were associated with whether an impression was accepted or rejected. Lower crown remake rates were associated with more experienced clinicians, optical impressions, and not using dual-arch trays.

Practical Implications. These results provide a snapshot of clinical care considerations among a diverse group of dentists. Clinicians can compare their own remake rates and impression evaluation techniques with those in this sample when developing best practice protocols.

Key Words. Crowns; impressions; dental laboratory; remake rates; practice network.

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Dentists commonly fabricate single-unit crowns by making a polymeric impression of the prepared tooth and then sending the impression to a laboratory for crown fabrication. Although other options are now available, such as optical impressions and in-office milling, most clinicians still use a traditional impression approach.[1-3] Before sending the impression to a laboratory, the clinician must evaluate and accept the quality of the impression to ensure a well-fitting, clinically acceptable crown. The quality of the impression can affect the fit of the crown, and some crowns must be remade, leading to increased chair time for both the patient and the dentist,[2-7] as well as increased operational costs for the practice.

Xtra Supplemental material is available online.

Few data exist to correlate the clinician's perceived quality of the impression to the characteristics of the dentist's practice. Although there is some general consensus about what constitutes a good quality impression, laboratories sometimes

conclude that the impressions they receive are suboptimal.[8] Evaluating impressions submitted to dental laboratories, investigators in 1 study found 89% of impressions contained errors in the registration of the preparation, which potentially could affect the accuracy of the restorations.[9] In several other articles, investigators examining impressions submitted to laboratories in Great Britain echoed this finding, with approximately 44% of impressions deemed unsatisfactory.[4,8,10] A call for improved impressions also has been made in the United States[5,6] and apparently has been a concern for decades.[11] In contrast, Mitchell and colleagues[12] rated 85% of impressions submitted to a commercial laboratory as good or excellent.

In considering what constitutes a clinically acceptable impression, the evaluation should include both material and clinical factors. The material chosen to make the impression must capture adequate surface detail, be dimensionally stable through disinfection and over time, offer dimensional accuracy, and provide elastic recovery.[2] These qualities generally are achieved using polymeric impression materials, which account for most impressions made today in general dental practice.[12] Clinical factors are those that the dentist can either control in some manner or evaluate and analyze for clinical acceptability. These clinical factors include visible defects such as incomplete margin detail, air bubbles, voids, pulls, unset impression material, contamination with blood or saliva, cords or cotton rolls trapped in the impression, inadequate union of materials, improper tray selection, and debris in the impression.[5,9,13] Other errors that distort the impression, but that might be harder to see, include impression recoil, detachment of the impression material from the tray, and plastic deformation.[13] Impression recoil occurs when an impression is inserted with some pressure, which on release changes the dimension of the impression; it typically is associated with a 2-stage putty wash technique.[13]

An accurate impression is required for consistent crown fabrication.[14] Several articles give instructions to clinicians about how to achieve an acceptable impression that accurately reproduces the prepared tooth. These include considerations as diverse as moisture control and patient comfort[7] and are considered important for clinical success.[15] A comprehensive understanding of the materials used,[16] as well as a consistent protocol among team members,[17] may facilitate impression making. Careful soft-tissue management, both before and during tooth preparation, can improve outcomes.[6,18]

Dentists must sometimes remake a crown instead of inserting it; for example, if the crown rocks on the tooth or the shade is incorrect. The dentist or the laboratory can make errors in fabricating crowns, but both groups, as well as the patient, are negatively affected by crown remakes. Common problems related to unacceptable crowns include inadequate impressions, inadequate preparations, inaccurate jaw relation records, disregarded prescriptions (miscommunication with the laboratory regarding materials, shade, and so on), poor clinical shade match, poor fit, and unsatisfactory anatomic form.[19-21]

The purpose of this study was to ask dentists to evaluate the quality of polymeric impressions on the basis of questionnaire photographs and correlate their responses to the characteristics of these dentists and their practices. We estimated laboratory remake rates on the basis of survey responses, and we documented clinicians' opinions regarding reasons for remaking crowns.

METHODS

This study is based on enrollment and study questionnaires completed by dentists in The National Dental Practice-Based Research Network ("the network"). The network is a consortium of dental practices and dental organizations focused on improving the scientific basis for clinical decision making.[22] Detailed information about the network is available on its website.[23] The network's applicable institutional review boards approved the study; all participants provided informed consent after receiving a full explanation of the procedures. Methods are published in detail elsewhere[24] and are summarized here.

Enrollment questionnaire. Practitioners completed an enrollment questionnaire to describe themselves, their practices, and their patient populations. This questionnaire is publicly available at https://www.nationaldentalpbrn.org/tyfoon/site/fckeditor/Network-EnrollmentQuestionnaire-2013-07-15-V9%200_1.pdf. We used questionnaire items, which had documented test and retest reliability, from our previous research in a practice-based study of dental care.[25,26]

Study questionnaire development. A study team of the authors, other dentists with clinical experience, statisticians, and laboratory technicians developed the questionnaire for this study. The purpose of the questionnaire was to measure practices in treatment planning, preparing, and fabricating single-unit crowns on natural teeth. Instrument Design, Evaluation, and Analysis Services, a group with expertise in questionnaire development and implementation, as well as National Institute of Dental and Craniofacial Research program officers and practitioners with prosthodontic content expertise, reviewed the survey. After extensive internal review, Instrument Design, Evaluation, and Analysis Services pretested the questionnaire via cognitive interviewing by telephone with a regionally diverse group of 8 practicing dentists. Cognitive interviewers probed the dentist's comprehension of each question. The interviewers also asked practitioners to identify items of clinical interest that were not addressed in the survey.