

The quality of fixed prosthodontic impressions

An assessment of crown and bridge impressions received at commercial laboratories

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The transfer of accurate records to the dental laboratory is an important part of prosthesis fabrication in fixed prosthodontics. Obtaining an optimal gingival displacement and an ideal impression for a fixed dental prosthesis is still 1 of the most challenging procedures in dentistry.^{1,2} Although many steps must be taken to fabricate an indirect restoration during which an error can occur, the technician can be expected to produce a quality restoration only if the impression is of adequate quality. All dentists must possess the ability to identify and analyze the quality of impressions because this ultimately will determine success of the restoration.³

Accurate transfer of records requires a general understanding of soft- and hard-tissue anatomy, especially in the area of the cervical finish line. Practitioners also need to understand how to select and manipulate gingival displacement and impression materials.³⁻⁸ Results from numerous studies demonstrate improvements in handling and accuracy of modern impression materials.^{6,9} However, despite these improvements, the quality of impressions sent to laboratories for fabrication of indirect restorations apparently has remained inadequate.^{3,8,10-13}

Relationships between dentists and laboratories tend to be less than ideal and often are relatively short

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ABSTRACT

Background. The authors evaluated and quantified clinically detectable errors commonly seen in impressions sent to commercial laboratories and determined possible relationships between finish line errors and other factors involved.

Methods. The authors visited 3 large and 1 small commercial dental laboratories over a 12-month period. Three calibrated examiners evaluated the impressions. The examiners evaluated all impressions for errors by using $\times 2.5$ magnification loupes under ambient room lighting without the aid of additional illumination.

Results. The authors evaluated 1,157 impressions; 86% of the examined impressions had at least 1 detectable error, and 55% of the noted errors were critical errors pertaining to the finish line. The largest single error categories evaluated were tissue over the finish line (49.09%), lack of unprepared stops in dual-arch impressions (25.63%), pressure of the tray on the soft tissue (25.06%), and void at the finish line (24.38%). The factors blood on the impression (odds ratio, 2.31; $P < .001$) and tray type (odds ratio, 1.68; $P < .001$) were associated significantly with finish line errors.

Conclusions. Marginal discrepancies made up the largest category of error noted in impressions evaluated. The authors noted an increase in errors at the finish line with dual-arch impression techniques and in the presence of blood.

Practical Implications. Dentists have ethical, moral, and legal obligations bestowed on them by the profession and need to evaluate critically the work they send to laboratories. The authors strongly recommend an improvement in technique and reviewing of all impressions and working casts.

Key Words. Laboratories; dental; impression material; restorative dentistry; fixed prosthetics.

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term.¹⁴ Results of a survey of 4 commercial dental laboratories in 1997 showed that 36% of the 290 impressions evaluated had visible defects.⁸ Two years later, results of another study showed the quality of 50% of impressions and dies to be unsatisfactory or unusable.¹⁵ In 2005, results of an evaluation of 193 impressions from 11 laboratories showed 89% of all impressions to have at least 1 appreciable error.³ This raises a question: If impression materials are improving constantly, why are impressions actually getting worse?

Although differences exist between materials, all require optimum technique in soft-tissue displacement, proper placement of the material around the preparation, and correct use of available impression trays.² One of the major causes of unacceptable impressions is poor gingival displacement.^{3,8,13} Another of the major causes of unacceptable indirect restorations is lack of understanding of the principles of impression making and understanding of what constitutes an acceptable impression.⁷ Proper manipulation of the impression material is arguably more important in determining the final accuracy of the impression than any characteristic of the material itself.^{6,9,16} On the basis of personal communication with laboratory owners, many technicians claim they are noticing a decrease in the quality of work they have been receiving over the years. The purpose of this study was to evaluate clinically detectable errors commonly seen in impressions for fixed prosthodontic restorations sent to commercial laboratories, determine their frequency, and determine possible relationships between finish line errors and other examined factors.

METHODS

Over a 12-month period from October 2013 through October 2014, we visited 3 large commercial dental laboratories and 1 small dental laboratory⁸ known to receive fixed prosthodontic impressions. We evaluated all impressions for conventional fixed dental prostheses received at these facilities on the days visited. We excluded impressions for veneers, resin-bonded fixed

partial dentures, and implant abutments. We evaluated impressions immediately after a standard disinfection protocol but before any other processing had been completed. When multiple abutments were impressed, we scored a defect on any abutment as a defect for the entire impression. If impressions had been poured with stone before being evaluated, we excluded them from the study population. We made no attempts to identify the dental offices from which the impressions originated; therefore, our study qualified for exemption from the Institutional Review Board of the University of North Carolina at Chapel Hill (exemption 14-2040).

Three examiners (C.T.R., V.G.O., A.J.D.) were calibrated by inspecting 10 impressions rejected from the University of North Carolina Dental School student clinics as being unacceptable for fixed dental prosthesis fabrication. After initial evaluation, the examiners discussed errors they noted and established criteria (Table 1). We did not analyze the calibration statistically because each listed error was objectively identifiable and agreed on by all examiners.^{3,8} All impressions were evaluated by 1 of 3 calibrated examiners according to

TABLE 1

Unacceptable criteria descriptions and frequencies.		
CRITERION	DESCRIPTION OF ERROR	FREQUENCY, NO. (%)
Finish Line, Void or Bubble	Any detectable void on the cervical finish line of a preparation	282 (24.38)
Finish Line, Lack of Wash Material	Cervical finish line recorded in heavy body or putty material with no wash above or below the finish line; monophasic excluded from error	60 (5.19)
Tray, Inadequate Retention of Material	Impression material pulling away from tray or not engaging tray retention features	30 (2.60)
Tray, Pressure of Tray on Soft Tissue	Vertical tray flanges exposed by displacement of impression material; any occurrence within 2 teeth of preparations or on the preparations	290 (25.06)
Tray, Show Through of Occlusal or Incisal Edges	Horizontal tray areas exposed by displacement of impression material; any occurrence within 2 teeth of preparations or on the preparations	201 (17.38)
Material, Inadequate Fusion of Viscosity	Lack of complete fusion between body and wash materials	121 (10.46)
Material, Void on Preparation	VOIDS not located on the finish line greater than 1 millimeter	154 (13.32)
Gingival Displacement, Tissue Over Finish Line	Lack of flash beyond the cervical finish line, detected by change of reflection or visible horizontal bur marks on the preparation for ill-defined margins	568 (49.09)
Gingival Displacement, Blood on Impression	Blood, coagulant, or any foreign materials around the cervical finish line	176 (15.22)
Dual Arch, Lack of Maximum Intercuspal Position*	No thinning of impression material over occlusal contacts; detected by holding impression against light source	61 (8.50)
Dual Arch, Unprepared Stops†	Lack of unprepared teeth anterior and posterior to the preparations	256 (25.63)
Dual Arch, Canine Recorded†	Lack of registering the complete maxillary and mandibular canine teeth	135 (13.51)

* Data for lack of capture of maximum intercuspal position is for dual-arch trays only (n = 718).

† Data for an error in recording the canine and unprepared teeth anterior or posterior to the abutments include both sectional dual-arch trays and single-arch trays because the same principles apply to both from a laboratory standpoint (n = 999).

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