



Quality of Fixed Prosthodontic Impressions Received by Dental Technicians in Casablanca: An Epidemiological Study

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Abstract

Introduction: Fixed prosthodontics requires an accurate impression of the teeth and the area to be restored to enable the laboratory to fabricate the desired restoration without errors. This study evaluated the quality of impressions received by private laboratories for the fabrication of fixed prostheses by describing the frequency of clinically detectable errors and analyzing them.

Materials and Methods: A cross-sectional study was conducted among 16 dental laboratories in Casablanca, assessing the quality of a sample of 410 fixed prosthesis impressions.

Results: The main findings were as follows:

- Five impressions were rejected by the technicians.
- Elastomers were used in 97.8% of cases.
- Dentists used the wash technique in 52.3% of cases and the double-mix technique in 45.9% of cases.
- The most frequently detected errors included: bubbles at the cervical margin (91.3%), bubbles on the preparation (45.2%), insufficient coverage of the entire arch by the impression material (42.5%), use of non-rigid impression trays (52.3%), bubbles in the canal (18.3%) and traces of blood on the impression (15.8%).

Conclusion: These results highlight a high frequency of detectable errors in fixed prosthesis impressions received by dental laboratories, which can lead to poorly fitting restorations for patients. It is therefore recommended that dentists conduct a more critical self-assessment of their impressions before sending them to the laboratory and enhance their skills and knowledge of impression materials and techniques.

Keywords: Fixed Prosthodontics; Impression Accuracy; Cervical Margins; Elastomeric Materials; Tray Rigidity; Quality Assessment

Introduction

Impressions in fixed prosthodontics constitute a critical step in the prosthetic workflow. It aims to reproduce intraoral structures with high accuracy, including prepared teeth, surrounding soft tissues, and adjacent and opposing dentition. Impression quality directly determines the accuracy of the definitive cast, thereby influencing marginal and occlusal adaptation of the restoration, as well as its functional and aesthetic integration. An inadequate impression may result in maladjusted restorations, leading to dental, periodontal, or occlusal complications.

Advances in impression materials, particularly elastomeric systems (silicones, polyethers), along with the introduction of digital optical impressions, have contributed to enhanced precision and a reduction in technique-related inaccuracies associated with conventional methods. Nevertheless, impression success remains dependent on multiple clinical and technical determinants, including tray selection, operator proficiency, and strict adherence to established protocols.

Several investigations have reported a substantial prevalence of errors in fixed prosthodontic impressions submitted to dental laboratories, particularly inaccuracies related to cervical margin recording [1,2].

Within this context, the present study aims to assess the quality of fixed prosthodontic impressions received by dental technician in Casablanca, to analyse recurrent defects, to identify their cause, and to propose avenues for improvement.

Materials and Methods

Study design and setting

This cross-sectional descriptive epidemiological study was conducted as part of a doctoral thesis in dentistry. Data collection was carried out in multiple private dental laboratories in Casablanca, Morocco.

Study period

The data collection phase extended over two months, from April 2 to June 5, 2024.

Target population

The study targeted legally established dental laboratories in Casablanca, collaborating with dentists for fixed prosthodontic procedures. The objective was to evaluate the quality of fixed prosthodontic impressions delivered to these laboratories prior to pouring, and to identify commonly encountered defects.

Inclusion criteria

The following were included:

- Dental laboratories located in Casablanca.
- Laboratories operating legally, officially registered, and compliant with regulatory activity.
- Laboratories whose scope of practice included fixed prosthodontics.
- Impressions delivered to the laboratory prior to pouring, for the fabrication of fixed prostheses.

Exclusion criteria

The following were excluded:

- Laboratories exclusively dedicated to removable prosthodontics.
- Impressions intended for implant-supported restorations.
- Impressions intended for removable prostheses, whether partial or complete.

Data collection tool

Data collection was performed using an anonymous assessment form specifically designed for this study and written in French. It contained three main sections:

- Practitioner-related data, particularly the sex of the dentist who performed the impression.
- Technical impression-related data, including requested restoration type, recorded arch, impression material, impression technique, number of prepared units, and type of tray.
- Observed impression defects, categorized into several domains (cervical margins, material-related errors, tray-related defects, root post space registration, gingival displacement, disinfection, occlusion).

Pilot survey

- Prior to the main survey, a pilot survey was conducted within the department of fixed prosthodontics in the Casablanca Centre for Dental Consultations and Treatments. The objective was to calibrate the investigators (two 6th-year dental students), test the assessment form, ensure adequate ability to detect defects, and anticipate potential challenges.

- Ten impressions produced by 4th-, 5th-, and 6th-year students were evaluated during this phase, with a mean filling form time of 2 minutes per form.
- Following this step, a minor modification was made to the section addressing disinfection-related defects. Pilot survey forms were not included in the final statistical analysis.

Main survey procedure

Laboratory selection was based on a pre-existing list derived from a study conducted in 2022 among dental technicians in Casablanca. This list was expanded through Google Maps searches and professional recommendations. Each laboratory was contacted by telephone to explain study objectives and obtain participation consent. Appointments were scheduled according to courier reception hours to allow evaluation of impressions prior to pouring.

Assessments were conducted in the plaster rooms of participating laboratories. Impressions were inspected visually under natural light by the investigators wearing examination gloves, without the use of magnification devices. Findings were recorded immediately on the evaluation forms.

Variables assessed

The following variables were analysed:

- **Practitioner-related variables:** Sex (male/female).
- **Technical variables:** Recorded arch, type of restoration (crown, bridge, veneer, inlay, onlay, endocrown, post-and-core, etc.), number of prepared units, impression material (elastomer, alginate, irreversible hydrocolloid), impression technique (monophase, simultaneous double-mix, wash technique), tray type (custom, metal, plastic, perforated or non-perforated).

- **Error-related variables:** Cervical margin reproduction defects (voids, tearing, insufficient coverage), material manipulation errors, tray-related defects, post impression defects, disinfection errors (presence of saliva, blood, or remains), occlusal inaccuracies in sectional impressions.

Statistical analysis

Collected data were entered and analysed using SPSS software (IBM SPSS Statistics). A descriptive analysis was performed. Quantitative variables were expressed as means \pm standard deviations, and qualitative variables were expressed as absolute frequencies and percentages.

Results

- A total of 410 impressions from 16 private dental laboratories in Casablanca were collected and assessed. Of these, 5 impressions were rejected prior to pouring by dental technicians, corresponding to a rejection rate of 1.2%. The analysis was therefore based on a final sample of 405 impressions.
- Regarding practitioner demographics, 52.7% of impressions originated from female dentists, indicating a relatively balanced sex distribution within this professional cohort.
- Most impressions, that is 56.6% involved the maxillary arch. In terms of requested restorations, cemented bridges and single crowns were the most frequently prescribed, accounting for 33.8% and 33.6% of cases, respectively (Table 1). The mean number of prepared units was 2.28 ± 2.121 , with single-unit preparations predominating (47.9%).
- Related to impression tray selection, 58% of practitioners used plastic trays (Table 2). Elastomeric impression materials were massively used in 98.3% of cases, whereas alginate was employed only marginally.
- From a procedural perspective, the wash technique (two-step) was used in 52.3% of the impressions investigated, while the simultaneous double-mix technique was used in 45.9%. The monophase technique was rarely observed.
- Qualitative assessment revealed a high prevalence of defects. Bubbles at the cervical margins were detected in 91.3% of impressions, and voids within the preparation area were observed in 45.2%. Inadequate extension of the low-viscosity material across the full arch was noted in 42.5% of cases.

Furthermore, 52.3% of impressions were made using non-rigid trays, potentially compromising dimensional accuracy.

- For root post space registration, voids within the canal were observed in 18.3% of cases. Gingival tissue was present at the cervical margin in 4% of impressions, and 15.8% showed visible blood contamination. No sectional occlusal impressions were received during the study period.

Restoration requested	Frequency, NO. (%)
Crown	136 (33.6)
Cemented bridge	137 (33.8)
Onlay	3 (0.7)
Inlay	2 (0.5)
Veneers	1 (0.2)
Resin-bonded bridge	23 (5.7)
RCR	97 (24)
Endocrown	3 (0.7)
Overlay	3 (0.7)
Total	405

Table 1: Frequency of restorations requested.

Type of impression tray	Frequency, NO. (%)
Perforated metal tray	160 (39,5)
Non-Perforated metal tray	9 (2,2)
Plastic tray	235 (58)
Custom tray	1 (0,2)
Total	405

Table 2: Frequency of type of impression tray used.

Discussion

The quality of impressions in fixed prosthodontics is a critical link in the prosthetic fabrication chain. Our study, based on 410 impressions evaluated in 16 private laboratories in Casablanca, identified multiple technical defects that may compromise cast precision and, consequently, marginal adaptation of the definitive restorations.

Practitioner-related findings

A relatively balanced distribution of impressions made between female and male practitioners was observed, with a slight

predominance of female dentists (52.7%). This contrasts with findings reported in Yemen, where a male/female ratio of 2.11 was documented [3]. Such discrepancies may reflect on region-specific demographic and socio-professional differences related to the studied regions

Technical findings related to the impression

Most impressions involved the maxillary arch (56.6%), consistent with studies of Nashum., *et al.* [1] and Al Odinee., *et al.* [3], who reported similar trends. The most frequently requested restorations in our study were single crowns (33.6%) and cemented bridges (33.8%), aligning with observations from Kenya and Malaysia where single crowns accounted for over 50% of cases [4,5].

These results are consistent with the general tendency to favor crowns and bridges as primary prosthetic solutions, although their distribution varies according to regional and local clinical practices. The observed differences in the prescription of various types of restorations, as well as the low demand for partial restorations such as inlays, onlays, or veneers, may reflect disparities in dentists' knowledge and experience, patients' awareness of oral health, and their socioeconomic status.

Our mean number of prepared units (2.28) is consistent with data from Nachum., *et al.* [1], who reported a predominance of single- and two-unit restorations, suggesting that localized rehabilitations remain the most common treatment modality, likely influenced by the economic context or the practitioner's preference for less invasive solutions.

Tray selection varied considerably across studies. In this survey, plastic trays predominated (58%), only one impression was made by a custom. Similar trends have been reported in studies elsewhere [1-4], often due to economic considerations, despite evidence that metal and custom trays provide superior rigidity, dimensional stability, and accuracy [6-8].

Elastomeric materials, particularly addition silicone, were used in the vast majority of impressions (97.8%), supporting their status as the reference material due to favourable dimensional stability, elastic recovery, and patient comfort [1,4,9,10]. Alginate was rarely used (1.7%), reflecting a notable shift compared with other countries such as Kenya and Yemen, where alginate remains widely used (97.9% and 50.9%, respectively) [3,5].

Thongthammachat, *et al.* reported that addition silicone demonstrated significantly superior accuracy compared with polyether. This was observed for each type of impression tray in this study [11].

The wash technique was the most common method of impression (52.3%), followed by the simultaneous double-mix technique (45.9%). These results are consistent with reports from Romania, Kenya, and Yemen [3,5,10].

The wash technique is widely recognized for improved marginal detail reproduction and dimensional stability [11].

Defects observed

A high prevalence of cervical margin defects was found in our survey, including bubbles (91.3%), tearing (24%), and insufficient marginal coverage (3.2%). These defects have also been widely documented in the literature [1-3,5] and may compromise marginal integrity.

Donovan, *et al.* emphasized that marginal accuracy is essential for the biological and functional longevity of fixed restorations [10].

Material pull (24.4%) and voids in the preparation area (45.2%) may reflect on improper viscosity management or inadequate application technique of the impression material [1,3,5]. Similarly, incomplete flow of light-body material across the full arch (42.5%) represents a frequent deficiency that may affect occlusal accuracy of the future restoration.

Tray-related defects, including translucency or excessive tissue contact, were observed in 19% of impressions, representing an intermediate rate compared with published reports [1,3,13]. Tray selection errors may induce clinically significant dimensional distortion [6,8].

Voids within post space canals were present in 18.3% of impressions. This may be attributed to reduced wettability of the light-body material, intracanal debris, or inappropriate injection tip selection. The low use of calibrated posts suggests frequent reliance on non-standardized anatomical preparations, which may compromise the accuracy of radicular recording and subsequent core fabrication.

In this study, 2.5% of impressions contained embedded retraction cords, a rate lower than that reported in Boston (6.2%) [1]. This may result from premature cord removal or a deliberate attempt to prevent marginal tearing. Gingival tissue at the cervical margin was found in 4% of impressions, far below than the 49.09% reported by Clayton, *et al.* [2]. These results emphasize the importance of adequate gingival displacement and hemostasis to ensure accurate margin capture.

Finally, disinfection and asepsis-related defects were identified, including visible blood contamination (15.8%), debris (2.5%), and lack of disinfection documentation. These shortcomings raise significant biosafety concerns, also highlighted in international studies [6,14,15].

Conclusion

The aim of this study was to evaluate the quality of fixed prosthodontic impressions received by dental laboratories in Casablanca.

The main defects identified were:

- 91.3% of impressions presented bubbles at the cervical margins.
- 45.2% showed bubbles on the preparation.
- 42.5% revealed incomplete coverage of the full arch by the low-viscosity material.
- 52.3% were made using non-rigid impression trays.
- 15.8% showed traces of blood contamination.

These findings demonstrate a high frequency of detectable defects in fixed prosthodontic impressions received by dental laboratories. This is particularly concerning, as it may result in poorly fitting prostheses for patients.

It is therefore recommended that dentists perform a more rigorous evaluation of their impressions prior to laboratory submission. Such improvement could be facilitated through participation in short conferences, intensive courses, or training programs to update and reinforce practitioners' knowledge and skills regarding modern materials and techniques in fixed prosthodontics. In the future, these training sessions could be organized by recognized institutions and directed toward general practitioners.

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