



Original Research

Evaluation of Disinfection Protocol Compliance for Alginate Impressions: A Clinical Dental Audit

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Abstract.

Background: Dental impressions are essential in prosthodontics but pose a risk of cross-contamination if not properly disinfected.

Objective: This audit aimed to evaluate compliance with alginate impression disinfection protocols in clinical practice and to assess the effectiveness of corrective measures after intervention.

Materials and Methods: A prospective observational audit was conducted in the Outpatient Department (OPD) of Altamash Institute of Dental Medicine. Compliance with each step of the alginate disinfection protocol was assessed during the first audit cycle using a standardized checklist. Following identification of deficiencies, staff training and reinforcement of infection control protocols were implemented. A second audit cycle was conducted to evaluate improvements.

Results: The first cycle revealed significant non-compliance, particularly in labeling and sealing steps. After corrective actions were implemented, the re-audit demonstrated marked improvement in overall compliance with the disinfection protocol.

Conclusions: Periodic audits, staff education, and strict adherence to standardized disinfection procedures are essential to ensure effective infection control and enhance patient safety in dental practice.

Clinical Application: Ensuring compliance with alginate impression disinfection protocols minimizes cross-infection risks and promotes a safer clinical environment for both patients and dental staff.

Keywords: Disinfection, Alginate, Impressions, Prosthodontics, Audit.

1. Introduction

Clinical audit (CA) is defined as “a systematic critical review of the quality of medical care, encompassing diagnostic and treatment procedures, resource utilization, and the patient’s outcome and quality of life”¹. Clinical audit is recognized as an important quality improvement tool in modern healthcare systems and is an integral component of effective clinical governance². Since CA requires comparing current practice with evidence-based best practice in the form of standards of care, identifying areas for quality improvement, and implementing adjustments to meet these standards, it has become a significant component of clinical professional practice. To enhance patient care, collaborative and systematic frameworks are needed for Clinical Audit. These frameworks enable an objective examination of healthcare delivery processes and ensure that healthcare professionals systematically evaluate their practice by highlighting inefficient procedures and identifying and encouraging appropriate practices, which leads to improved patient-care systems¹⁻⁴.

Disinfection of dental impressions and casts is a crucial aspect of dental practice, as it protects dental personnel from potential exposure to harmful microorganisms, including viruses that cause hepatitis B, hepatitis C, herpes, HIV, and *Mycobacterium tuberculosis*^{1,2}. To mitigate these risks, disinfection procedures must be performed by using hospital-grade disinfectants (sodium hypochlorite, glutaraldehyde, iodophor), which must be registered with the Environmental Protection Agency (EPA), especially in the United States of America^{5,6,7}.

In modern dentistry, a wide variety of materials are available for taking both primary and secondary impressions, with hydrocolloids and elastomeric polymers being the most used. However, dental impressions are always contaminated with saliva and frequently contaminated with blood, necessitating prompt disinfection immediately after impression removal. Clear labelling is crucial to prevent contamination and cross-contamination. To address this risk, various chemical agents are employed for cleaning and disinfecting these impressions, including sodium hypochlorite, glutaraldehyde, chlorhexidine, iodophor, and peracetic acid. These disinfectants ensure that the impressions are properly sanitized before being handled by dental staff or further used in patient care⁸⁻¹¹. Among them, glutaraldehyde and sodium hypochlorite are presumably the most often utilized disinfectants^{12,13}.

Since 1988, the American Dental Association (ADA) has advised immersing all impression materials in sodium hypochlorite for the manufacturer's specified contact time, which is no longer than minutes^{14,15}. Medical organizations have recently proposed guidelines for infection prevention and control across multiple nations. According to these guidelines, impressions are recommended to be disinfected with 0.5% sodium hypochlorite or 2% glutaraldehyde for 10 min using a spray or immersion disinfection method^{16,17}. Therefore, all dental staff who often handle these imprints must be aware that they are fomites, potentially spreading dangerous illnesses so they should adhere to the guidelines provided by the Centers for Disease Control (CDC) and ADA for disinfecting dental impressions¹⁸⁻²⁰.

We are all familiar with alginate impression material and the fact that it's a widely used material in routine dental practice. However, there is a recognized need to improve awareness and adherence to its disinfection protocols among healthcare professionals. To ensure compliance with infection control standards, this audit is being undertaken in Outpatient Department (OPD) of Altamash Institute of Dental Medicine to evaluate adherence to established guidelines for the disinfection of alginate impressions.

There have been no published audits on adherence to alginate disinfection protocols in Pakistan. This audit is unprecedented in the country, highlighting a significant knowledge gap. It is hoped that this study will establish a foundation for future research aimed at advancing clinical practice.

The primary objective of this audit is to assess and enhance compliance with infection control protocols, aiming for 100% adherence among all team members involved in the disinfection process. By ensuring these protocols are rigorously followed, we seek to protect both patient and staff safety, while upholding regulatory standards for infection prevention.

1.1 Audit Standards

Standards were taken from the ADA, A12 sheet infection control, British Dental Journal (BDJ)²¹, CDC, and Australian Dental Association guidelines for infection control in dental healthcare settings²². They stated that "The dentist and dental staff are exclusively responsible for making sure that impressions and appliances have been cleaned and disinfected before being sent to the laboratory". The following guidelines are recommended:

1. Hand hygiene and Personal Protective Equipment (PPE) should be considered when handling patient care items.
2. To remove contamination from impressions, thoroughly rinse them with cold running water for 15-30 seconds to eliminate saliva and traces of blood. Continue the process until the impressions are visibly clean. If any impression is grossly contaminated, it should be cleaned in an ultrasonic bath containing detergent and then rinsed.
3. Drying alginate impressions after rinsing (air or blot dry) and before applying disinfectant to prevent dilution of the disinfectant solution.
4. Then, apply a diluted detergent (1:10 dilution of 0.5% sodium hypochlorite in mineral water). This can be done by immersing in a solution of detergent or by spraying the diluted detergent onto the impression (e.g., in a plastic bag for 10 minutes). The impression or appliance should be disinfected according to the manufacturer's recommendations.
5. Thorough rinsing for 15-30 seconds is then undertaken to remove the detergent. This second rinsing step must continue until all visible contamination is removed. Once this is completed, the impression is deemed to be decontaminated.
6. Impressions were required to be sealed in plastic bags and clearly labeled before being transported, ensuring safe handling and preventing cross-contamination.

Criteria:

Each step was measured against a 100% ideal compliance standard for infection control.

2. Materials and Methods

2.1 Ethical Clearance

This study was conducted with prior approval from the Ethical Review Committee (ERC) of the Altamash Institute of Dental Medicine with a project number AIDM/ERC/04/2024/03.

2.2 Study Duration

The first phase of auditing commenced on August 1st, 2024, and extended through September 30th, 2024, followed by data analysis in December 2024. An action plan with training was implemented from January 1st to April 30th, 2025. The second auditing cycle was conducted from May 1st to June 31st, 2025. Data analysis of the 2nd phase occurred during July 2025.

2.3 Study Design and Setting

This prospective observational audit was conducted in the outpatient department of institute.

2.4 Sample Size and Technique

To ensure a comprehensive evaluation of compliance with alginate impression disinfection protocols, stratified sampling was employed. The dental staff responsible for performing alginate impressions were divided into distinct subgroups, based on their roles:

1. House Surgeons.
2. Postgraduate (PG) Trainees.
3. Dental Assistants.

From each subgroup, a purposive sample of alginate impressions was selected for observation and assessment. Impressions with visible blood or debris were excluded to ensure that the disinfection process being audited was evaluated under standard conditions.

A sample size of 30 impressions per cycle was recorded and assessed according to the standards set by ADA, A12 sheet infection control and CDC guidelines for infection control in dental health-care settings. In this audit, operators performing routine alginate impression disinfection procedures were observed for compliance with standard protocols. The procedure included rinsing impressions under running water for 15–30 seconds to remove saliva and visible blood, drying (air or blot dry) to avoid dilution of the disinfectant, and applying a 1:10 dilution of 0.5% sodium hypochlorite solution by spraying for a contact time of 10 minutes. Observers also noted whether operators carried out the second rinse (15–30 seconds) to eliminate residual disinfectant. Finally, compliance with sealing impressions in plastic bags and labeling them before transport was evaluated.

2.5 Inclusion Criteria

1. All alginate impressions made in the OPD during the audit period, free of blood or debris were included.
2. Only the chemical disinfection method was employed.
3. Personnel handling alginate impressions included dental assistants, postgraduate trainees, and house surgeons.

2.6 Exclusion Criteria

1. Impressions derived from materials other than alginate, such as polyether or silicone, were excluded.
2. Impressions that showed visible contamination with blood or debris were excluded as they required additional disinfection steps not covered by our audit protocol.
3. Disinfection methods based on physical techniques, such as ultraviolet and microwave disinfection, were excluded.
4. Impressions for which any part of the data collection (e.g., compliance log sheet) was incomplete or missing were excluded, as this made accurate assessment impossible.

2.7 Data Collection Methods

2.7.1 Data Collection Tool

A comprehensive data collection sheet was developed in MS Excel 2019 version 16 to assess compliance with infection control protocols. The sheet included key parameters such as hand hygiene, the use of PPE, initial rinse, drying, disinfectant contact time, post-disinfection rinse, sealing in a bag, and labeling. Compliance with each step of the protocol was recorded. To calculate the overall compliance score, the following formula was applied:

$$\text{Compliance (\%)} = (\text{Number of fully compliant procedures} / \text{Total number of procedures}) \times 100.$$

2.7.2 Operational definition

Hand hygiene: Defined as washing or sanitizing hands with soap or an alcohol-based hand rub immediately before handling the impression. Recorded as 'Yes' if performed and 'No' if skipped²³⁻²⁵.

Use of personal protective equipment: Defined as wearing gloves and a face mask at minimum, and preferably protective eyewear, during impression disinfection. Recorded as 'Yes' if PPE was worn appropriately and 'No' if incomplete or absent⁶.

Pre-disinfection rinse: Defined as thoroughly rinsing the alginate impression under running tap water until it was visibly free from blood and saliva. Recorded as 'Yes' if the rinse was carried out adequately and 'No' if omitted¹⁴⁻¹⁶.

Spraying (disinfectant application): Defined as evenly applying 0.5% sodium hypochlorite spray to fully cover the impression surface, ensuring a minimum contact time of 10 minutes. Recorded as 'Yes' if the protocol was followed and 'No' otherwise²⁶.

Post-disinfection rinse: Defined as rinsing the impression under running water after the disinfection contact period to remove any residual disinfectant. Recorded as ‘Yes’ if completed and ‘No’ if skipped ¹⁴⁻¹⁶.

Drying: Defined as blotting with clean tissue/gauze or gentle air-drying of the impression after the post-disinfection rinse. It was recorded as ‘Yes’ if the drying step was performed and ‘No’ if the impression was left wet ²⁷.

Sealing: Defined as placing the disinfected impression into a clean, sealable plastic bag or container for transport to the laboratory. Recorded as ‘Yes’ if the impression was properly sealed and ‘No’ if left unsealed ¹⁶.

Labeling: Defined as clearly marking the sealed bag or container with patient identification (name/ID, date, and procedure details) and recorded as ‘Yes’ if the label was present and ‘No’ if missing ²⁰.

2.7.3 Data Collection procedure

The audit was conducted among assistants, postgraduate trainees, and house surgeons who were routinely responsible for making alginate impressions for patients and carrying out their subsequent disinfection in the OPD. These operators were observed during their routine clinical duties over an initial period of two months by two independent observers trained in infection control protocols. To minimize bias and avoid influencing the operators’ behavior (Hawthorne effect) ²⁸, they were not informed that their impression disinfection procedures were under evaluation. Each time an operator completed the process of making an alginate impression and proceeded with its disinfection, the observer carefully monitored the steps performed. Immediately after each step, the observer recorded whether the procedure was carried out correctly, partially, or not at all in a structured electronic data sheet.

Following the first cycle, targeted feedback and corrective measures were implemented based on identified deficiencies. For the second cycle, data collection was repeated using the same methodology, with the same operator groups, observers, and data sheet, over an equivalent time.

2.7.4 Pilot Testing

The clinical audit data collection was pilot tested on 10 impressions procedure performed by the OPD staff prior to the first phase of audit to ensure the validity and reliability of procedures ²⁹⁻³¹. Emphasis was placed on ensuring that the observers fully understood the consistent use of the data collection sheet in order to minimize errors in data collection.

2.7.5 Data Collectors

Two trained observers (T.B) and (A.Y) recorded each procedure. They independently extracted data from five sample alginate impression cases, following the infection control protocol parameters outlined in the audit (e.g., hand hygiene, PPE use, rinsing, disinfectant application, drying, sealing, labeling). The inter-rater reliability was calculated using the percentage of agreement method recommended by Dixon and Pearce ²⁹. In this method, first we multiply the

number of parameters used in the study by the number of cases taken to check reliability and then divide the number of parameters for which there was complete agreement among the data collectors by the total number of parameters assessed. For example, in our study we have 8 parameters, and we wanted 5 cases to check reliability. Then it was calculated as shown in Table 1.

Table 1. Inter-rater reliability between observers according to Dixon and Pearce method, yielding a 95% agreement rate.

A	No. of parameters or standards per case	8
B	No. of cases selected to test reliability	5
C	No. of parameters or standards per case*no. of cases selected to test reliability	8*5=40
D	Number of bits of data for which there was complete agreement among the data collectors (each of the 5 cases was reviewed by each data collector)	38
E	Inter-rater reliability = $D/C=38/40*100$	95%

*8 parameters of impression making procedures were recorded in this study

Since the number of agreements between both observers was 38 out of 40 observations, this indicates a 95% agreement rate and excellent inter-rater reliability. This shows that the data collection process is robust, with minimal bias or variability risk between individuals collecting data.

2.8 Data Analysis

Compliance for each protocol step (hand hygiene, use of PPE, pre-disinfection rinse, drying, spraying, post-disinfection rinse, sealing, and labeling) was recorded as binary outcomes (Yes/No) for 30 impressions. For each factor, the compliance percentage was calculated. Descriptive statistics (frequencies and percentages) were used to summarize compliance for each factor as well as overall compliance. Exact binomial tests were applied to assess whether observed compliance differed from the 100% audit standard. To compare compliance across the eight protocol steps within the same 30 impressions, Cochran's Q test was used, followed by McNemar's test with Bonferroni correction for post-hoc comparisons where required. A significance level of $p < 0.05$ was adopted. Data was analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA).

3. Results

Compliance for each protocol step was assessed against the 100% audit standard using exact binomial tests. In Cycle 1, compliance with the disinfection protocol was highly variable across steps. The highest compliance was observed for spraying (76.7%), followed by drying (66.7%) and post-disinfection rinse (63.3%). In contrast, sealing (0.0%) and labeling (0.0%) demonstrated no compliance (Table 2, Figure 1). Hand hygiene (20.0%), PPE use (16.7%), and pre-disinfection rinse (20.0%) were also poorly adhered to. Cochran's Q test confirmed significant variation in compliance across the eight steps ($Q = 58.7$, $df = 7$, $p < 0.001$) (Table 3). Post-hoc pairwise comparisons (Table 4) revealed that spraying had significantly higher compliance than sealing, labeling, pre-disinfection rinse, hand hygiene, and PPE ($p < 0.001$). Post-disinfection rinse and

drying also showed significantly greater compliance compared to sealing and labeling.

Following intervention and reinforcement (Table 5), overall compliance improved substantially in Cycle 2. Hand hygiene (83.3%), PPE use (73.3%), and pre-disinfection rinse (66.7%) showed marked improvement compared to Cycle 1. Spraying achieved the highest compliance (93.3%), while drying (70.0%) and labeling (66.7%) also improved significantly. Sealing compliance increased from 0.0% in Cycle 1 to 53.3% in Cycle 2. Despite these improvements, compliance for post-disinfection rinse (60.0%) remained suboptimal and slightly decreased compared to Cycle 1 (63.3%). Cochran’s Q test again demonstrated statistically significant differences across protocol steps ($Q = 58.7, df = 7, p < 0.001$), consistent with Cycle 1. Post-hoc comparisons confirmed that spraying, drying, and post-disinfection rinse remained significantly higher than sealing and labeling.

Table 2. Compliance with disinfection protocol steps during Cycle 1 and Cycle 2 of the clinical audit

Protocol step	Cycle 1 Compliance (%)	Cycle 2 Compliance (%)
Hand hygiene	20.0%	83.3%
Personal Protective Equipment (PPE)	16.7%	73.3%
Pre-disinfection rinse	20.0%	66.7%
Spraying	76.7%	93.3%
Post-disinfection rinse	63.3%	60.0%
Drying	66.7%	70.0%
Sealing in a bag	0.0%	53.3%
Labeling	0.0%	66.7%

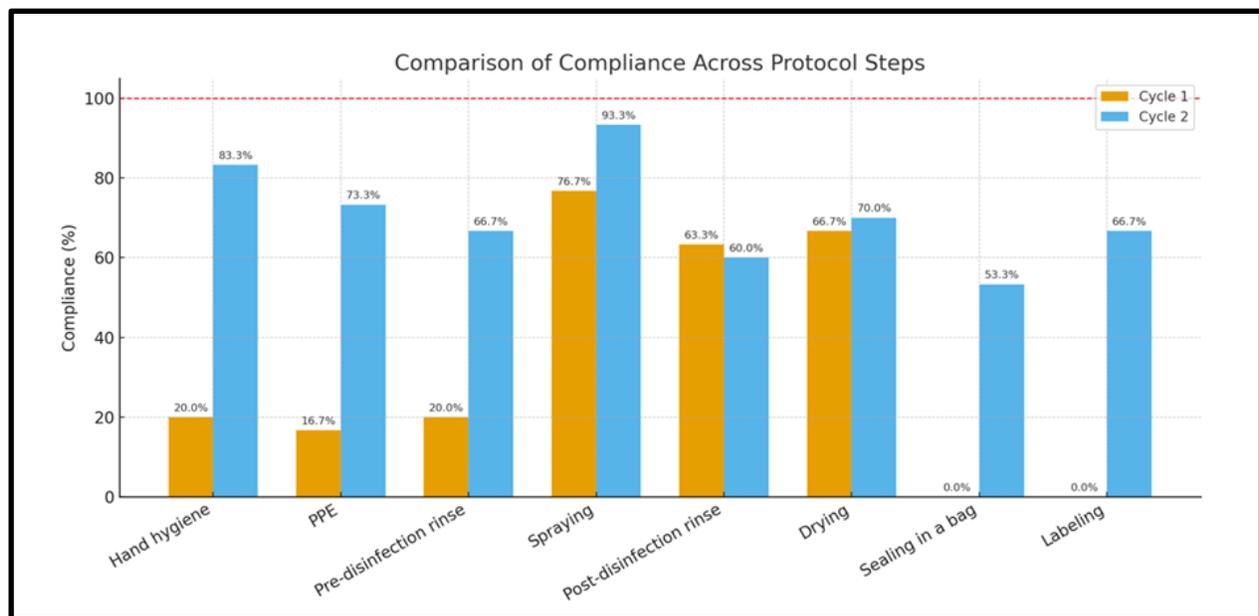


Figure 1. Comparison of compliance across disinfection protocol steps between Cycle 1 and Cycle 2. A reference line at 100% indicates the ideal compliance standard.

Table 3. Global comparison across disinfection protocol steps (Cochran’s Q Test).

Test	Q value	df	p-value
Cochran’s Q Test (cycle 1)	58.7	7	<0.001
Cochran’s Q Test (cycle 2)	58.7	7	<0.001

Table 4. Post-hoc pairwise comparisons between protocol steps during Cycle 1 and Cycle 2 of the audit (McNemar’s test with Bonferroni correction).

Comparison	p-value (Cycle 1)	Significant after Bonferroni?	p-value (Cycle 2)	Significant after Bonferroni?
Spraying vs Sealing	0.000000	Yes	0.000000	Yes
Spraying vs Labeling	0.000000	Yes	0.000000	Yes
Post-disinfection rinse vs Sealing	0.000002	Yes	0.000002	Yes
Drying vs Sealing	0.000002	Yes	0.000002	Yes
Drying vs Labeling	0.000002	Yes	0.000002	Yes
Pre-disinfection rinse vs Spraying	0.000015	Yes	0.000015	Yes
Hand hygiene vs Spraying	0.000031	Yes	0.000031	Yes
PPE vs Spraying	0.000076	Yes	0.000076	Yes

Table 5. Highlights targeted action areas to improve compliance with disinfection protocols, emphasizing education, clear guidelines, regular monitoring, and constructive feedback

Action Area	Specific Measures
Staff training and education	Mandatory training sessions to ensure proper disinfection techniques.
Clear protocols	Step-by-step visual guidelines in key disinfection area.
Monitoring and re-auditing	A weekly compliance checklist was introduced and a re-audit performed in 3 months.
Feedback and improvement	Members received ongoing feedback focusing on continuous improvement and adherence to protocols.

4. Discussion

The purpose of the audit is to evaluate compliance of infection control measures in the OPD of Altamash Institute of Dental Medicine for disinfecting alginate after making an impression and it was discovered that the majority of the operations weren't carried out by the disinfection protocols. Numerous criteria, such as hand hygiene, the use of PPE, and proper disinfection techniques, were utilized to evaluate compliance during the audit. However, unsatisfactory findings were achieved, and operators were found to have failed to complete the disinfection standards.

The findings from this initial audit cycle demonstrate significant deficiencies in compliance with alginate disinfection methods. Spraying had the highest compliance rate, (28.23%), however, it is still well below acceptable standards, and crucial steps like sealing and labeling were entirely neglected. Hand hygiene compliance was 9.42% which is relatively low. This suggests that hand hygiene practices might require significant improvement in the dental practices being audited. The compliance rate for proper usage of PPE is even lower at 7.06%, indicating a major gap in ensuring adequate protection measures are followed. There are further guidelines for hand hygiene and PPE proposed by WHO ^{7,23-25} and in our audit if those protocols were not fulfilled, we marked as 'No' in the data sheet. Compliance with the pre-disinfection rinse protocol compliance is also low, that only 8.22% of procedures adhered to the standards for rinsing alginate impressions before disinfection. With 28.23% adherence, spraying compliance is the highest among all the factors. Although this is better than other steps, there is still substantial room for improvement in ensuring proper spraying contact time (at least 10 minutes). Both post-disinfection rinse and drying procedures showed the same compliance percentage of 23.54%. While these steps are more consistently followed, they are still below optimal standards. Two factors showed a complete lack of compliance, indicating that no procedures adhered to sealing and labeling protocols, which are critical for preventing contamination during transport or storage. This might be due to a lack of knowledge, unavailability, limited resources, or resistance to changing behavior.

Following this first cycle, questionnaires were distributed among operators to identify the barriers they faced in following the standard disinfection protocol. Based on the issues highlighted, targeted interventions were implemented, and in the second audit cycle, a marked improvement in compliance was observed across several steps of the disinfection process. Although compliance improved markedly in Cycle 2, Cochran's Q test continued to demonstrate significant variability between protocol steps ($Q = 58.7$, $df = 7$, $p < 0.001$), similar to Cycle 1. This indicates that while reinforcement strategies were effective in raising overall compliance, adherence across individual steps remained inconsistent, with certain steps such as spraying achieving much higher compliance compared to sealing, labeling, and post-disinfection rinsing.

In our study, sodium hypochlorite (0.5%) was used as a disinfectant for alginate impressions, applied via spraying method with a contact time of 10 minutes, consistent with the recommendations given by Bayan S Khalaf³². Physical disinfection techniques, such as microwave or ultraviolet disinfection were not employed in our audit as they require special equipment and because chemical disinfectants such as sodium hypochlorite and glutaraldehyde are easier to employ and more versatile for usage with dental impression materials. Also, we added drying as an important step in protocols. According to Hatrick²⁶ in his book *Dental Materials: Clinical*

Applications for Dental Assistants and Dental Hygienists, it is recommended to dry alginate impressions after rinsing and before applying disinfectants to prevent dilution of the disinfectant solution. This book discusses the alginate impression disinfection process, including the potential benefit of a drying step to optimize disinfection. He also discussed that the dental office has the primary responsibility for disinfection which is opposed to the guidelines by the Occupational Safety and Health Administration ²⁷, but regulations advised proper packaging and labeling of contaminated items.

Additionally, in our study, we assessed inter-rater reliability before data collection following the guidelines provided by Dixon N, Pearce ²⁹. The 95% success rate in achieving inter-rater reliability can be attributed to two key factors: first, the comprehensive and effective training provided to the observers assured they understood the assessment criteria well. Second, the parameters being judged were objective, leaving little room for personal interpretation or bias. This combination of solid training, clear and measurable metrics helped to eliminate potential errors and maintain consistency across observations. The strength of this audit lies in the thorough assessment of important infection control methods, pointing out existing practices and potential development opportunities, high inter-rater reliability minimizing chances of biases, and doable suggestions for improvement in compliance rate. A key limitation of this audit is the limited number of alginate impressions observed, which may restrict the broader applicability of the results. Additionally, the observations were limited to a single clinical setting, which may not fully reflect practices in other institutions, not considering colony-forming units to monitor bacterial load changes post-implementation limiting the ability to assess the true effectiveness of the infection control changes, excluding impressions with blood and gross contamination limiting the audit's scope, potentially overlooking the effectiveness of disinfection protocols under more challenging conditions. Also, we did not use an ultrasonic bath in our disinfection process, which could have improved debris removal and bacterial reduction; this omission may underestimate the potential benefits of more rigorous cleaning methods. Finally, the second audit cycle, conducted after implementing corrective measures from the first cycle, demonstrated substantial improvements in operator compliance with disinfection protocols, thereby enhancing patient safety and strengthening the quality of healthcare delivery.

4.1 Implications for Clinical Practice and Future Research

To safeguard patient safety, the audit highlights the importance of adhering to infection control measures for alginate impressions. In clinical practice, maintaining high compliance necessitates ongoing audits, standard operating procedures, and frequent staff training. Subsequent investigations should focus on refining disinfection techniques, analyzing sustained compliance, and evaluating the results. It should also include measuring bacterial load counts to ascertain whether there is a decrease in bacterial contamination following the implementation of modifications to infection control procedures.

4.2 Recommendations

It is recommended to include standardized processes, enhanced staff training, and step-up monitoring to ensure conformity. Process upgrades, improved documentation practices, more accountability, and specific issues discovered during the audit are all being addressed and criteria proposed by Charles³³ for best practices in clinical audit should be followed. The updated ADA guidelines also recommend appointing an infection prevention coordinator at every dental practice. In addition to creating written infection control regulations, this coordinator ensures that staff members follow infection prevention guidelines. They also oversee the supplies and equipment required to handle infection control. Reprocessing equipment or performing laboratory work should not take place in the same room while patients are being treated. If these activities must share a space, patient treatment and instrument reprocessing/laboratory work should not occur simultaneously. Implementing this recommendation can significantly reduce the risk of infection transmission and improve safety for both patients and staff³⁴⁻³⁸.

5. Conclusion

The audit successfully highlighted significant gaps in compliance with alginate impression disinfection protocols during the first cycle, particularly in relation to hand hygiene, PPE usage, and proper sealing and labeling of impressions. Following targeted feedback and reinforcement of guidelines, the second audit cycle demonstrated measurable improvement in adherence, although 100% compliance was not achieved. These findings indicate that regular monitoring, structured instruction, and continuous reinforcement can enhance compliance with infection control protocols, thereby improving both patient and staff safety. Future audits should incorporate microbial analysis to correlate protocol adherence with actual bacterial load reduction, providing further evidence of effectiveness.

Abbreviations

CA	Clinical Audit
EPA	Environmental Protection Agency
ADA	American Dental Association
CDC	Centers for Disease Control
OPD	Outpatient Department
BDJ	British Dental Journal
PPE	Personal Protective Equipment
ERC	Ethical Review Committee

Declarations:

Supplementary Materials

Not applicable.

Informed consent statement

Informed consent was not required, as no patient identifiers or personal data were collected during

the observational audit.

Consent for publication

Consent for publication was not required as no individual patient data or identifiable information are included in this report

Availability of data and materials

All data was included in the article.

Competing interest

The authors declare no conflict of interest.

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Author Contributions

Conceptualization, T.-S, A.-Y, N.-A, A.-M, S.M.L.-M and A.U.-K.; **methodology**, T.-S, A.-Y, and N.-A.; **software**, T.-S, A.-Y, and N.-A.; **validation**, A.U.-K, N.-A, and S.M.L.-M ; **formal analysis**, T.-S, A.-Y, N.-A. and S.M.L.-M; **investigation**, T.-S, A.-Y, N.-A, A.-M.; **resources**, T.-S, A.-Y, N.-A.; **data curation**, A.-Y, T.-S, N.-A.; **writing—original draft preparation**, T.-S, A.-Y, N.-A. and S.M.L.-M.; **writing—review and editing**, T.-S, A.-Y, N.-A.; **visualization**, N.-A, T.-S, A.-Y. and S.M.L.-M.; **supervision**, N.-A. and S.M.L.-M.; **project administration**, A.-Y, T.-S, N.-A, A.-M.; **funding acquisition**, A.U.-K, N.-A. All authors have read and agreed to the published version of the manuscript.

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