Knowledge, Attitude & Practice Regarding Dental Unit Waterline (DUWL) System Disinfection Among Dental Students & Practitioners: A Cross-Sectional Survey

.

ABSTRACT

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| **Aims:** This study aimed to determine knowledge, attitude and practice regarding Dental Unit Waterline (DUWL) System Disinfection among dental students and practitioners.  **Study design:** cross sectional study.  **Methodology:** This was an observational, qualitative, questionnaire based online survey. A questionnaire was administered online using Google Forms. Sample size was calculated as n = 180.  **Results:** Of the 180 dentists who received the questionnaire Postgraduate (0.34 ± 0.586) had higher mean knowledge score compared to undergraduate (0.18 ± 0.385), The difference was found to be significant statistically. However, there was no significant difference in mean attitude and practice scores between different groups.  **Conclusion:** The dental practitioners who responded to this survey generally did not disinfect or test their DUWLs.However, they were concerned with the well-being of the patient and were ready to adopt an effective method of DUWL disinfection |

*Keywords: Dental Unit Waterlines; Biofilms; Disinfection; Decontamination; Dental Students; Dental Practitioners; Cross-Sectional Studies; Infection Control*

1. INTRODUCTION

The title "Knowledge, Attitude & Practice regarding Dental Unit Waterline (DUWL) System Disinfection among Dental Students & Practitioners" is highly relevant in the context of dental public health and infection control. DUWLs are known sources of microbial contamination due to biofilm formation, leading to the delivery of non-sterile water during dental procedures. This is an area that is often overlooked despite it posing a significant risk to both patients and dental professionals, especially in the case of immunocompromised individuals.

Focusing on the knowledge, attitude, and practice (KAP) framework allows the study to assess not only awareness of DUWL disinfection protocols but also beliefs and behaviors that influence compliance. Evaluating KAP among dental students and practitioners offers a comprehensive view of both educational preparedness and long-term adherence to infection control practices.

The findings can help inform curriculum development, policy formation, and continuing professional development (CPD) initiatives, ultimately contributing to improved disinfection practices, safer clinical environments, and better patient outcomes. Overall, the title reflects a study of practical and academic value aimed at promoting a culture of safety and accountability in dental care.

Dental professionals rely on a variety of apparatuses, such as dental chair units, ultrasonic scalers, and high-speed handpieces, to maintain and restore oral health. [1] Among these, dental unit waterlines (DUWLs) play a crucial role, supplying water for cooling equipment and irrigating the oral cavity during dental treatments. [1, 2]

Studies have demonstrated that DUWLs harbor various microorganisms, such as Legionella pneumophila, Pseudomonas aeruginosa, and Staphylococcus aureus, which can have severe implications, particularly for immunocompromised individuals. [3- 6]

Consequently, DUWL contamination becomes a potential source of cross-infection, threatening both patients and dental healthcare personnel.^11^ Despite these risks, there are currently no universal standards or legislation governing the microbial quality of DUWLs, leaving the responsibility of maintaining water quality largely on dental practitioners.[4] .

The presence of these pathogens in DUWLs necessitates risk management strategies to reduce microbial contamination to acceptable levels, such as less than 500 CFU/ml heterotrophic bacteria, as recommended for potable water.[8,9] Various guidelines and recommendations have been proposed by professional organizations and governmental bodies to aid dental practitioners in maintaining the quality of their DUWL systems.[10]

2. material and methods

Study Design

This study employed a cross-sectional survey design to investigate the knowledge, attitudes, and practices of dental students regarding dental unit waterline (DUWL) decontamination. The study utilized a structured, pre-tested questionnaire adapted from previously validated instruments, specifically those used in studies by Burke et al. (2005)[ Burke FM, O’Mullane D, O’Sullivan M. Attitudes of Irish and European dentists to water quality of dental unit water systems. J Ir Dent Assoc 2005;51:119-25.] and Kengadaran et al.[16 ]

**Survey Instrument**

The questionnaire comprised three sections:

1. Demographics: Collected data on participant characteristics, including gender, level of study.

2. Knowledge: Assessed participants' knowledge of DUWLs, including contamination sources, potential risks, and recommended decontamination procedures.

3. Attitude: Evaluated participants' attitudes towards DUWL decontamination, including perceived importance and willingness to adhere to recommended practices.

**Data Collection**

The questionnaire was administered online using Google Forms. Participants were required to complete all questions before proceeding to the next section. To ensure confidentiality, participant anonymity was strictly maintained. No personally identifiable information was collected.

3. results and discussion

Data was analyzed using descriptive statistics. Numerical variables were presented as mean and standard deviation (SD) for normally distributed data.

To explore associations between demographic factors—such as gender, educational level, , received information, guidance, and personal experiences—and the knowledge and attitude scores, statistical analyses were performed using Pearson’s correlation coefficient and independent t-tests.

Knowledge and attitude scores were assessed quantitatively, with higher mean scores indicating a better understanding and a more positive attitude towards DUWL disinfection.

The sample size of 180 participants was determined based on an estimated population of dental students and practitioners in the institution, using a confidence level of 95% and a margin of error of 5%, which is standard in cross-sectional surveys [31]. Stratified convenience sampling was applied due to logistic feasibility.

Out of 180 participants, comprised of 124 (68.9%) undergraduate and 56 (31.1%) postgraduate students, participated in this study. This imbalance in representation was due to limited postgraduate availability during the data collection period, which introduces a sampling bias.

Table 1 shows demographic profile and information of the respondents (n = 180). The mean knowledge score of undergraduates (0.18 ± 0.385) and postgraduates (0.34 ± 0.586) was found to be statistically significant (P = 0.005), indicating higher knowledge levels among postgraduates, likely due to increased clinical exposure [18, 22].

**Table 1 Demographic profile and information of the respondents (n = 180)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | | **N** | **%age** |
| **Level of study** | Undergraduate | 124 | 68.9 |
| Post Graduate | 56 | 31.1 |
| **Gender** | Male | 36 | 20.0 |
| Female | 144 | 80.0 |
| **Received information on DUWLS** | Yes | 56 | 31.1 |
| No | 100 | 55.6 |
| Not Sure | 24 | 13.3 |
| **Source of information** | Attended talk/course | 68 | 37.8 |
| Attended curriculum lecture | 52 | 28.9 |
| Internet | 8 | 4.4 |
| From a teacher | 8 | 4.4 |
| Haven't received | 44 | 24.4 |
| **Received guidance on DUWLS** | Yes | 28 | 15.6 |
| No | 128 | 71.1 |
| Not Sure | 24 | 13.3 |
| **Source of guidance received** | Attended talk/course | 76 | 42.2 |
| Attended curriculum lecture | 44 | 24.4 |
| Internet | 8 | 4.4 |
| From a teacher | 8 | 4.4 |
| Haven't received | 44 | 24.4 |
| **Personal experience in managing DUWLS** | Yes | 20 | 11.1 |
| No | 136 | 75.6 |
| Not Sure | 24 | 13.3 |

Table 2 and 3 detail specific knowledge and practices regarding DUWLs.

**Table 2 Sociodemographic profile and information of the respondents (n = 180)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | | **N** | **%age** |
| **Type of water supplied to dental chair unit** | Distilled water | 112 | 62.2 |
| Hard water | 20 | 11.1 |
| Soft water | 32 | 17.8 |
| Deionized water | 16 | 8.9 |
| **Water used for DUWLS** | Surgical | 52 | 28.9 |
| Non-surgical | 128 | 71.1 |
| **Biofilm formation acts as reservoir in DUWLS** | Yes | 56 | 31.1 |
| No | 100 | 55.6 |
| Not Sure | 24 | 13.3 |
| **DUWLS contains potentially pathogenic microorganisms** | Yes | 72 | 40.0 |
| No | 92 | 51.1 |
| Not Sure | 16 | 8.9 |
| **Contaminated DUWLS is dangerous to immunocompromised patients** | Yes | 88 | 48.9 |
| No | 84 | 46.7 |
| Not Sure | 8 | 4.4 |
| **Is DUWLS disinfection part of disinfection control measure** | Yes | 104 | 57.8 |
| No | 68 | 37.8 |
| Not Sure | 8 | 4.4 |
| **Frequency of DUWLS disinfection** | Daily & weekly | 76 | 42.2 |
| Weekly only | 36 | 20.0 |
| Monthly only | 28 | 15.6 |
| Yearly only | 40 | 22.2 |

**Table 3. Knowledge of the dental students on DUWLS (n=180)**



**Table 4: Attitude of the dental students towards DUWLS (n=180)**

**Table 5: Factors associated with the knowledge on DUWLS among dental students (n=180)**





**Table 6: Factors associated with the attitude towards DUWLS (n=180)**

Discussion: Discussion: Water delivered from DUWLSs is not sterile and may harbor bacteria such as Legionella pneumophila, Pseudomonas aeruginosa, and Staphylococcus aureus [5, 6, 7]. The study revealed that while knowledge and attitudes towards DUWL disinfection were generally favorable among dental students and practitioners, gaps remained in actual practices. Although 62.2% reported using distilled water, only 57.8% identified DUWL disinfection as part of routine infection control, suggesting gaps in awareness. Only 28.9% used surgical water for DUWLs, while a worrying 22.2% reported disinfecting DUWLs yearly, far below recommended frequencies [10, 25, 26].

In our study, the comparison was done between the study subjects based on their level of education. Mean difference in knowledge on DUWLS was significant (t=6.07, p=.000) with post-graduates having higher mean score. This aligns with previous research suggesting that advanced education and specialized training contribute to a more comprehensive understanding of infection control protocols.[18]

In our study, the comparison was done between the study subjects based on gender. Mean difference in knowledge on DUWLS of males and females was significant (t=3.65, p=.000) with females having higher mean score. This finding may reflect a difference in learning behavior or training exposure and warrants further investigation to explore potential factors contributing to this disparity[23]

Mean difference in knowledge on DUWLS was higher (F=18.42, p=.000) among those who received information of DUWLS than those who did not receive information. This highlights the crucial role of education and training in improving awareness and understanding of DUWL disinfection procedures.

Mean difference in knowledge on DUWLS was higher in those who had personal experience of DUWLS (F=15.63, p=.000) than those with no personal experience of DUWLS.This suggests that practical involvement reinforces theoretical knowledge.

The independent t-test results revealed a significant mean difference in attitude towards DUWLS between undergraduate and postgraduate dental students (t=4.23, p=.000), with postgraduate students showing a higher mean score. This suggests that the level of study (undergraduate or postgraduate) was significantly associated with attitude towards DUWLS, with postgraduate students having a more positive attitude than undergraduate students. Postgraduate students and practicing dentists exhibited higher knowledge and better practices, likely due to increased clinical exposure and experience.

Mean difference in attitude towards DUWLS between male and female dental students was not significant (t=0.77, p=.440 > .05), indicating no significant association between gender and attitude towards DUWLS.

Mean difference in attitude towards DUWLS between dental students who received and those who did not receive information about DUWLS was not significant (F=0.11, p=.893 > .05), suggesting that receiving information was not significantly associated with attitude towards DUWLS.

Mean difference in attitude towards DUWLS between respondents who received guidance and those who did not was not significant (F=1.66, p=.193 > .05), indicating that receiving guidance was not significantly associated with attitude towards DUWLS. The lack of significant differences in attitude scores based on prior information or guidance suggests that mere exposure to information may not suffice; practical training and reinforcement are essential.

Mean difference in attitude towards DUWLS between respondents who had personal experience with DUWLS and those who did not (F=3.72, p=.026 < .05), with those having personal experience showing a higher mean score.

The positive correlations among knowledge, attitude, and practice underscore the interdependence of these domains. Although students reported high awareness, attitudes did not always translate into consistent practices. This discrepancy may stem from the lack of institutional reinforcement, accessibility to disinfection products, or perceived irrelevance in academic settings. These findings are in line with Lahoti et al. (2021) who emphasized that awareness of emerging tools like virtual technologies does not always imply adoption in practice [31].

There is need for comprehensive infection control training in dental curricula and continuing education programs. Our results align with global research calling for comprehensive infection control education and structured guidelines for DUWL maintenance. Countries like Malaysia and the USA have published national guidelines to maintain DUWL water quality, yet awareness among future dental professionals remains suboptimal [11, 12].

Despite the knowledge gap between the undergraduate and postgraduates, both groups showed a favourable attitude towards DUWLS decontamination. They are open to regular microbiological testing of the water and clear advice on disinfection of dental unit water supply. Making available simple and quick methods to assess water quality and monitor the effectiveness of treatments would help in achieving this goal.

Future educational interventions should focus on enhancing knowledge and translating positive attitudes into consistent and appropriate disinfection practices to safeguard both patients and dental healthcare professionals from the potential risks associated with contaminated DUWLs. Microbiological monitoring and commercial testing kits should be used to bridge the knowledge-practice gap.

4. Conclusion

While knowledge and attitudes toward DUWL disinfection were generally positive, disparities existed based on education level, gender, prior exposure, and clinical experience. Postgraduates and females demonstrated better knowledge. Most participants agreed on the importance of DUWL disinfection and expressed interest in further training. Thus, integrating structured workshops, CPD programs, and regular microbiological testing in dental curricula is vital to enhance safe dental practices. However, the unequal sampling distribution among gender and academic levels may limit generalization, and future studies should aim for balanced stratification.

Most participants agreed on the importance of DUWL disinfection and expressed interest in further training. Thus, integrating structured workshops, CPD programs, and regular microbiological testing in dental curricula is vital to enhance safe dental practices.

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

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