

Applying Instrumental Reprocessing Procedure for Dental Care Providers in Private dental clinics

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Abstract:

Dental instrumental reprocessing is too important to control many seriously pathogens potentially transmitted through dental procedures. The dental care providers, at the private dental clinic, play an essential role to apply dental instrumental reprocessing by true way to avoid cross infection. **Aim:** Applying instrumental reprocessing procedure for dental care providers in private dental clinics at Helwan District. **Design:** A quasi experimental design was used.

Setting: The study was conducted for all dental care providers working in private dental clinics at Helwan District, these are 57clinics.

Sampling: convenient sample was used. **Sample size:** 195 dental care providers.

Tools: two tools were used (1) an interview questionnaire included; demographic characteristics, dental care providers' knowledge, (2) an observation checklist to assess dental care providers' practices.

Results: The current study denoted that there was an improvement of nurses' total knowledge and practices score at the post, than the pre-test, Paired t-test pre was 4.68929, while Paired t-test Post was 19.095 with statistically significant difference.

Conclusion: Improvement in reported dental care providers' knowledge and practices at the posttest than that of pretest, with statistically significant differences.

Key words: Private Dental Clinic, Instrumental Reprocessing, Dental care providers.

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I. Introduction:

Infections may be transmitted through dental procedures by several routes, including transmission of infection from patient to dental clinic staff, from patient-to-patient. Mode of transmission is direct or indirect, the direct transmission: implies the immediate transfer of the disease agent between the infected and the susceptible individuals by direct contact such as touching, biting, sneezing, coughing, spitting, or talking. Indirect transmission through three types includes airborne, vehicle borne and vector borne. Air borne transmission: dissemination of microbial aerosols to a suitable portal of entry; vehicle borne: transmission of contaminated materials serve as vehicles – nonliving objects by which communicable agents are transferred to a susceptible host such as dental contaminated instruments [1].

Dental instruments are essential devices aid in the dental procedures provided to the clients at dental clinics, so that should be completely sterile to avoid transmission of pathogens. Reprocessing term is referred to cleaning, disinfection, sterilization, and preparation of equipment to complete ready for use. The dental instruments reprocessing aimed to prevent cross-contamination, removal of all visible and invisible debris. If any steps of dental instruments reprocessing involved inadequate or experience failures, they lead to increase the acquired infections [2].

Preferred use dental instruments only once to minimize any risk of infection transmission, but that leads to increase the economic burden, so, health care organizations tend to apply reprocessing of the dental instruments. The reprocessing of dental equipment should be followed in three essential steps: cleaning, disinfection and sterilization. The first step in dental instruments reprocessing is cleaning, it is considered the most essential step because it aid to remove large numbers of microorganisms, and successful disinfection and sterilization steps. Cleaning is defined as a process, usually involving removing foreign materials (dirt or microorganisms) from instruments. In cleaning step there are two types Mechanical Cleaning or Manual Cleaning [3].

Mechanical cleaning: The equipment is placed in trays ready for washing by: washing machine, it gives a cold rinse followed by a hot wash at 71°C for 2 minutes. This is followed by a 10-second hot water rinse at 80-90°C and then by drying by a heater or a fan at 50-75°C; **Washer/disinfectant:** It runs a 45-minute cycle of washing and cleaning plus a 2-minute cycle with water at 80-100°C and with a detergent solution; or **ultrasonicator:** it is a sophisticated and expensive but extremely efficient piece of equipment, it uses high-power output of 0.44 W/cm³ and dislodges all organic matter [4].

Manual Cleaning: It is the most simple, common and cost-effective method in the dental clinic in this step using tap water and liquid soap is used to remove blood, sputum, etc., these secretions may be coagulated by heat and it became difficult to remove so that tap water should be used. The brush used in this step to clean the inner surfaces of the instruments, keeping the brush below the surface of the water in order to prevent release of aerosols. The brush should be decontaminated after use and should be dried; it is the best method especially if the instruments are complex [5].

Disinfection is the second step in dental instruments reprocessing, it is carried out by chemical processes disinfectant, known by destruction of pathogenic and other kinds of microorganisms by chemical solutions disinfectant. Low-level disinfectant (LLD) means destroys all vegetative bacteria (except tubercle bacilli), lipid viruses, some non-lipid viruses, and some fungus, but not bacterial spores. Intermediate level disinfectant (ILD) refer to destroy all vegetative bacteria, including tubercle bacilli, lipid enveloped and some non-lipid enveloped viruses, and fungus spores, but not bacterial spores. High-level disinfectant (HLD) refers to a disinfectant killing some bacterial spores when used in sufficient concentration and under suitable conditions. It does not kill high numbers of bacterial spores [6].

Disinfection step should involve drying all instruments, because wet instruments dilute reducing efficiency of the chemical solution. The disinfectant solution should be prepared in sterile container and suitable in the material to avoid corrosive the metals, according to manufacturer's instructions. The fresh solution should be made each day but if using a previously prepared solution an indicator strip should be used to determine if the solution is still effective, then mark container with preparation date and expiration date. The solution must contact all surfaces of the dental instruments to improve the disinfection process [7].

Place all items in the solution so that they are completely submerged. Place bowls and containers upright, not upside-down, so that they fill with the solution. Cover the container and allow items to soak for 20 minutes. During this period, do not add or remove any items from the container. Monitor the time and remove the items from the container using, dry, high-level disinfected pickups such as forceps; Rinse thoroughly with boiled water to remove the chemical residue that is left on items, this residue is toxic to skin and to tissues, and place items to air-dry on a high-level disinfected tray or in a high-level disinfected container before use or storage. Use instruments and other items immediately or keep them in a covered, dry, high-level disinfected container and use within one week [8].

Sterility, it is the method to remove or destroys all forms of microbial life including bacterial spores by either physical or chemical processes. The selection of sterilization method depends on type of instrument material, type of microorganisms, and availability of sterilization these are: steam under pressure (autoclaving), dry heat (hot air oven) or chemicals. Types of autoclaves are small table-top sterilizers, gravity downward-displacement sterilizers and high-speed pre vacuum sterilizers. Dry heat sterilization: it is preferred for reusable glass, metal instruments, oil, ointments and powders [9].

Monitoring the effectiveness of sterilization is important to ensure that the sterilization process is successful or not through using different indicators such as, mechanical indicators this type of indicators allows observing time, temperature, and/or pressuring readings during the sterilization cycle, while chemical indicators tape with lines that change color when the intended temperature has been reached, pellets in glass tubes that melt, indicating that the intended temperature and time have been reached, indicator strips that show that the intended combination of temperature, time, and pressure has been achieved, and biological indicators these indicators use heat-resistant bacteria end spores to demonstrate whether or not sterilization has been achieved. If the bacterial end spores have been killed after sterilization, then assume that all microorganisms have been killed as well. After the sterilization process the strips are placed in a broth that supports aerobic growth and incubated for 7 days [10].

Sterilization of dental instruments is the important step for eliminating and destroying all kinds of virus bacteria's, fungi and parasites to reduce infectious transmitted diseases as hepatitis and AIDS the dental professional should follow the universal precautions procedure for sterilization and treat every patient as being potentially infectious [1].

Significance of the study:

Dental problems are a major health problem influencing approximately 90% of individuals in worldwide. Most developing low income countries complain from elevates prevalence rates of dental problems. An estimated 5 billion individuals worldwide complain from dental problems [11].

Egypt is one of the low to middle income countries, suffers from poor dental health in its population, especially in rural area and Upper Egypt. The latest national oral health survey in Egypt, which was carried out in 2014, revealed that 55% of patients visit dental clinic complain from infections related to unsterile dental instruments, it is

considered as danger alarming, so that applying instrumental reprocessing procedure is very important for dental care providers that should be compulsory [12].

The community health nurse plays a vital role in providing a procedure for dental care providers to improve their awareness regarding instrumental reprocessing, by applying appropriate assessment dental care provider's knowledge and practices toward applying instrumental reprocessing, and providing guidance for applying ideal procedures about dental instrumental reprocessing [13].

Aim of the study

The study aimed to evaluate the effects of applying instrumental reprocessing procedure for dental care providers in private dental clinics at Helwan District, through the following:

- 1- Assessing dental care providers ' knowledge and practices regarding instrumental reprocessing procedure
- 2- Implementing instrumental reprocessing procedure for dental care providers in private dental clinics.
- 3- Evaluating the effect of instrumental reprocessing procedure for dental care providers in private dental clinics.

Research hypotheses:

- **H1:** The dental care providers working in private dental clinics will have an improved knowledge after applying instrumental reprocessing procedure.
- **H2:** Practices of dental care providers working in private dental clinics will be improved after applying dental instrumental reprocessing procedure.
- **H3:** There will be a significant association between dental care providers' knowledge, practices and their socio characteristic regarding dental instrumental reprocessing.

Subjects and Methods

Design: a Quasi-experimental design was used.

Setting: The study was conducted on all dental care providers, working in private dental clinics at Helwan district; they are 57 private dental clinics.

Subjects:

A convenient sample (all dental care providers working in private dental clinics at Helwan district was recruited. The number of dental care providers included in the study was 195 persons who fulfilled the following criteria: accept to participate in this study.

Tools:

Tool 1: A questionnaire (pre- post format)

A questionnaire sheet was designed for the purpose of assessing dental care providers' knowledge and practices about dental instrumental reprocessing. Develop of the questionnaire was guided by relevant articles in periodicals, scientific lectures, and internet. It consisted of 2 parts:

Part I: This part is concerned with demographic characteristics of dental care providers as age, residency, level of education, marital status etc.

Part II: This part deals with dental care providers' knowledge about dental instrumental reprocessing. It includes 10 close ended questions on Arabic language related to; meaning of dental instruments reprocessing, importance, steps of dental instrumental cleaning, time should be taken to marinate the instruments, importance of dryness of instruments after cleaning step, etc.

The answers were scored based on the level of knowledge of the studied subjects. Each question had 3 possible responses: complete correct answer (2), correct and incomplete answer (1), and incorrect answer (0). The total score is 20. The higher score indicates a greater level of knowledge. Nurses' answers were compared with a model key answer and accordingly their knowledge was categorized into either:

- ❖ Poor knowledge: less than 60%.
- ❖ Fair knowledge: 60 -75 %.
- ❖ Good knowledge: >75%.

Tool II: Observation checklist:

This tool was developed to assess the level of applying practices of dental care providers about dental instrumental reprocessing. It includes 5 items related to; cleaning step, disinfection step, sterilization step, steps of wrapping dental instruments, and dental care providers reported monitoring sterilization of dental instruments, which include 41 sub items.

The scoring system for practices includes a score of two was given to dental care providers for the task done correctly, while a score of one was given to the dental care providers for the task done incorrectly or sometimes, and a score of zero was given to the dental care providers for the task not done. The total score was 82. The higher score indicates a greater level of practices. The dental care providers' practices were categorized into either:

- Unsatisfactory practices: < 60%.
- Satisfactory practices: ≥ 60%.

Method included:

- **Preparatory phase:**

Construction of the health educational intervention; the first step in constructing this program was to determine the objectives. A review was done of the past, current related literature, covering various aspects of instrumental reprocessing to dental instruments in addition to the use of available books, articles, periodicals, magazines, and internet search, to get acquainted with the research problem and develop the study tools, and the intervention content.

- **Validity:**

The tool was distributed among a group of experts (three in the field of community health nursing, two of occupational medicine, and one of medical surgical nursing). According to experts' opinions, the researchers made all modification suggested.

- **Reliability:**

The reliability of the modified scale was done using the internal consistency method. All tools used in the present study showed good to very good reliability as follows: Knowledge tool (Cronbach's alpha coefficient = 0.792) and practice tool (Cronbach's alpha coefficient = 0.942).

- **Pilot study:**

A pilot study was performed on 10 % of dental care providers of studied sample equal 18 dental care providers, males and females, to evaluate the content of the tools. A pilot study was used to assure clarity of questions, to remove any ambiguity, also helped to estimate the time required for application of the tools develop. Those who shared in the pilot study were excluded from the main study sample after modifications were done on the tools.

- **Field work:**

Data were collected from beginning of April 2016 up to the end of August 2016. It was out by the researchers for dental care providers working at private dental clinics at Helwan District. An official approval was obtained from the study settings to carry out the study. A clear explanation was given about the nature, and the expected outcomes of the study. The researchers started to collect data and explain objectives of the study during the interview. The researcher started each phase with a summary for a previous one. The researcher used different teaching methods to evaluate nurses' knowledge and practices pre – post implementation of the program.

I. Assessment phase:

The researchers first introduced themselves and explained the purpose of the study briefly to the nurses. Every nurse was met individually and an oral consent for participation was obtained. The dental care providers were assured that the obtained information will be treated confidentially, and used only for the purpose of the study. The researchers read, and explained each item of the study scales in front of the nurse and recorded his/her responses to each item. The time consumed for answering the study questionnaire ranged from 25-40 minutes. Data were collected over a period of five months from the beginning of April 2016 to end August 2016.

2. Planning phase:

Based on the results obtained from the assessment phase, the researchers designed the instrumental reprocessing procedure sessions contents according to various aspects of instrumental reprocessing to dental instruments. The applying instrumental reprocessing procedure sessions were developed after reviewing of related literature, and needs,

requirements detected were clarified and discussed in the form of a booklet. Contents of the booklet were selected on the base of identified needs. The booklet consisted of two main parts: the first a theoretical part, which included knowledge about various aspects of instrumental reprocessing to dental instruments. The second part is a practical one, which included applying various aspects of instrumental reprocessing to dental instruments. Methods of teaching used in the training sessions included lectures, discussions, booklet, giving life situation examples, brain storming, role-play and demonstration. Media used were pictures, videos and illustrated colored booklet prepared by researchers.

3. Program implementation phase:

An interviewing questionnaire sheet was applied pre- and post- tests with each dental care provider, which took 25-40 minutes. The application of instrumental reprocessing procedure was divided into sessions; each session takes 25-45 minutes and was applied three times week, over a period of 5 months. To ensure that the dental care provider understands the booklet content, each session started by a summary about what was given through the previous one and objectives of the new one were explained, taking into consideration the use of simple language to suite the educational level of dental care providers. Motivation and reinforcement techniques as praise, and recognition during the session were used to enhance motivation and learning.

4) Evaluation of the training program:-

Immediately after the implementation of application of instrumental reprocessing procedure each dental care provider was assessed using the study tools (dental care providers' knowledge about dental instrumental reprocessing) and (dental care providers' practices of applying dental instrumental reprocessing procedures), to determine the effect of the sessions on their knowledge and practices after applying the training sessions.

Ethical considerations

- Confidentiality of information was guaranteed.
- Verbal consent was obtained from each participant before each questionnaire.
- The researchers informed the participants about their right to withdraw from the study at any time, without giving any reason.

IV. Statistical Design

Data entry and analysis were done using the Statistical Package for Social Sciences (SPSS) (version 22) and state graphics statistical software packages. Data were presented using descriptive statistics in the form of frequencies and percentages. Wilcoxon signed-rank test was used to compare between knowledge and practice scores before and after applying training. Friedman's test was used to compare between knowledge levels (poor, fair & good) before and after applying training. Cochran's Q test was used to compare between practice levels (inadequate & adequate) before and after applying training. Spearman's correlation coefficient was used to determine correlations between total knowledge and total practice scores. Chi-square test was used to find the association between knowledge and practice levels. Linear regression analysis was performed to detect significant predictors of knowledge and practice scores. ANOVA (f-test) was used to test model fit. Coefficient of determination (r^2) was used to find the correlation between dependent and independent variables in the model. Regression coefficients with their 95% confidence intervals (95% CI) were calculated. The significance level was set at $p < .05$.

II. Results:

Table (1): Shows the distribution of dental care providers' socio-demographic data. As for age, 54.2% of them were 20 - <30 years, 53.1% had diploma education, 62.7% were female and 67.2% had insufficient income. As for occupation around on third was dentist, nurse and others (32.2%, 30.5% & 37.3 respectively).

Table (2): Clears dental care providers' correct knowledge regarding dental instrumental reprocessing statistically. There are statistically significant enhancements in the studied subjects' correct knowledge in all items in the post/program than pre/program ($P < 0.001$).

Table (3): Reveals that statistically significant enhancements in total knowledge score level of the studied sample, regarding dental instrumental reprocessing items in the post- program than preprogram ($P < 0.001$).

Table (4): Shows statistically significant improvements in dental care providers reported practices regarding most all items cleaning, disinfecting and sterilizing of dental instruments in the post-program than preprogram ($P < 0.001$).

Table (5): Displays statistically significant improvements in the dental care providers reported practices regarding half of the steps for wrapping of dental instrument in the post-program than preprogram ($P < 0.001$).

Table (6): Shows that statistically significant improvements in the dental care providers' reported practices regarding monitoring sterilization of dental instrumental in the post-program than preprogram in all items of mechanical techniques, half of the items of chemical indicators, while in none of items of biological monitors ($P < 0.001$).

Table (7): Displays statistically significant enhancement in total score practices reported from the studied sample in the post-program than preprogram, ($P < 0.001$).

Table (8): Clears that highly statistically significant differences in the correlations between total knowledge score and total reported practices' score of the dental care providers regarding dental instrumental reprocessing post program ($P < 0.001$).

Table (9): The table showed that positive correlation between dental care providers' socio-demographic data with their post total knowledge score and practices score regarding dental instrumental reprocessing.

Table (1): Distribution of Dental Care Providers Socio-demographic Data (n=177).

Items	No.	%
Age groups (in years)		
• 20 - <30	96	54.2
• ≤ 30- >40	77	43.5
• ≤ 40	4	2.3
Mean ±SD	1.48± 0.545	
Educational level		
• Diploma	94	53.1
• Institute	20	11.3
• University	63	35.6
Gender:		
• Male	66	37.3
• Female	111	62.7
Family income		
• Sufficient	58	32.8
• Insufficient	119	67.2
Occupation		
• Dentist	57	32.2
• Nurse	54	30.5
• Others	66	37.3

Table (2): Distribution of Dental Care Providers' Correct Knowledge Regarding Dental Instrumental Reprocessing (n =177).

Items	dental care providers 's Correct answers		χ^2 P
	Pre%	Post%	
Define dental instruments' reprocessing	13	80.2	19.003 0.001*
Importance of dental instruments' reprocessing	14	75.7	19.249 0.001*
Importance of cleaning step in instruments reprocessing	31	93.8	23.785 0.001*
Steps of dental instruments cleaning	27	79.1	17.628 0.001*
Time should be taken to marinate the instruments	45	82	15.119 0.001*
Importance of dryness of instruments after cleaning step	56	76.3	11.911 0.001*
Steps of instruments packager	55	83.1	13.802 0.001*
Types of sterilization used in dental instruments	46	75.1	13.044 0.001*
Steps of dental instruments sterilization	33	75.1	15.119 0.001*
Concentration of the bleach used to disinfect the surfaces	41	77.4	13.827 0.001*

*Significant (P<0.05)

Table (3): Total Knowledge Score levels among the Studied Sample Regarding Dental Instrumental Reprocessing (n =177).

Total knowledge	Dental care providers				t-test P
	Pre		Post		Pre / Post
	No	%	No	%	
Total knowledge levels:					46.171 0.001*
➤ Poor (<60%) (0 - < 6)	150	84.74	10	5.64	
➤ Fair (60-75%) (6- < 8)	27	15.25	48	27.12	
➤ Good (< 75%) (8-10)	0	0	119	67.24	

Total knowledge scores:			
Range (0-10)	(0-5)	(4-8)	
Mean± SD	2.0960±1.171	8.00±1.4771	

*Significant (P<0.05)

Table (4): Dental Care Providers' Reported Practices Regarding Cleaning, Disinfecting and Sterilizing of Dental Instruments (n=177).

Items	Dental care providers				χ^2 P
	Pre%		Post%		
	Done	Not done	Done	Not done	
I) Cleaning step					
▪ Applying routine hand washing before working	27.7	72.3	70.6	29.4	28.187 0.001*
▪ Wearing personal protective equipment before instruments cleaning	23.7	76.3	75.7	24.3	17.617 0.001*
▪ Using liquid soap during instrument cleaning	22.6	77.4	77.4	22.6	15.089 0.001*
▪ Cleaning the instruments from inner to outer	19.8	80.2	73.4	26.6	15.773 0.001*
▪ Rinsing the instruments after cleaning by soap	8.5	91.5	78	22	4.632 0.020
▪ Drying the instruments after rinsing by clean towel	12.4	87.6	78.5	21.5	6.868 0.003
II) Disinfecting step					
▪ Heat intolerance instruments using disinfect solutions	35	65	75.1	24.9	31.570 0.001*
▪ Put the instruments in disinfecting solution to allow pass inner the instruments	15.3	84.7	71.2	28.8	12.896 0.001*
▪ Applying the disinfect solutions' manufacturing instructions such as suitable time to disinfect	21.5	78.5	77.4	22.6	14.128 0.001*
▪ Rinsing the instruments by using sterile salt solution	16.9	83.1	75.7	24.3	11.592 0.001*
▪ Drying the instruments by sterile towels	18.1	81.9	73.4	26.6	14.122 0.001*
III) Sterilizing step					
A. Chemical sterilization.					
▪ Heat intolerance instruments using chemical sterilization	23.2	76.8	70.6	29.4	22.198 0.001*
▪ Use suitable time to put the instruments in the chemical sterilization following manufacturing instructions	14.7	85.3	78.5	21.5	8.332 0.001*
▪ Rinsing the instruments by sterile solutions	20.3	79.7	76.3	23.7	14.060 0.001*
▪ Drying the instruments by sterile towel	16.9	83.1	72.9	27.1	13.441 0.001*
B. Heating sterilization					
▪ Heat -tolerant instruments sterilizing at dry oven and steam autoclave	19.2	80.8	75.7	24.3	13.505 0.001*
B.1. Dry heating sterilization.					
▪ Time take for unwrapped instruments	15.8	84.2	79.1	20.9	8.791 0.001*
▪ Time take for wrapped instruments	15.3	84.7	78.5	21.5	8.710 0.001*
B. 2. Steam sterilization.					
▪ Time taken for unwrapped instruments	18.1	81.9	80.8	19.2	9.287 0.001*
▪ Time taken for wrapped instruments	15.8	84.2	77.4	22.6	9.711 0.001*

General practices related to sterilizing dental instruments					
▪ Write the date of sterilization on the instruments	14.7	85.3	81.4	18.6	6.984 0.003
▪ Peak up the unwrapped instruments by forceps	17.5	82.5	75.7	24.3	12.060 0.001*

*Significant (P<0.05)

Table (5): Differences between Dental Care Providers pre and post Steps for Wrapping of Dental Instrumental (n =177).

Items	Dental care providers n = 177				χ^2 P
	Pre%		Post%		
	Done	Not done	Done	Not done	
▪ Place the instruments or other items in the center of the top wrapper they should be positioned so that the points –not the flat edges- are at the top, bottom, and sides	15.8	84.2	76.8	23.2	10.027 0.001*
▪ Fold the bottom section of the top wrapper to the center, and fold back the point	12.4	87.6	78.5	21.5	6.868 0.003
▪ Fold the left section to the center, and fold back the point	14.1	85.9	81.4	18.6	6.671 0.004
▪ Fold the right section to the center, and fold back the point	13.6	86.4	80.8	19.2	6.601 0.004
▪ Fold the top section to the center, and fold back the point	16.4	83.6	78	22	9.802 0.001*
▪ Fold the bottom section of the bottom wrapper to the center, and fold back the point.	17.5	82.5	78.5	21.5	10.274 0.001*
▪ Fold the left section to the center, and fold back the point.	15.3	84.7	80.2	19.8	7.852 0.002
▪ Fold the right section to the center, and fold back the point.	17.5	82.5	76.8	23.2	11.330 0.001*
▪ Fold the top section to the center, and fold back the point.	19.8	80.2	80.2	19.8	10.753 0.001*
▪ Tuck the point under the right left sections.	13.6	86.4	79.1	20.9	7.338 0.002
▪ Fasten the folds securely, using autoclave tape, if available.	18.1	81.9	75.7	24.3	12.535 0.001*

*Significant (P<0.05)

Table (6): Percentage Distribution of Dental Care Providers' Regarding Monitoring Dental Instruments Sterilization (n =177).

Items	Dental care providers				Chemical indicators χ^2 P
	Pre%		Post%		
	Done	Not done	Done	Not done	
Mechanical techniques					
▪ Assess cycle time, temperature, and pressure by observing the gauges or displays on the sterilizer	15.8	84.2	74.6	25.4	11.339 0.001*
▪ Note these parameters for each load	19.2	80.8	78	22	11.893 0.001*
▪ Use sterilization mechanical monitoring weekly	17.5	82.5	80.2	19.8	9.263 0.001*
Chemical indicators					
▪ Use sensitive chemicals to assess physical conditions such as time, temperature or the presence of steam during the sterilization process	18.6	81.4	82.5	17.5	8.613 0.001*
▪ Use sterilization chemical indicator monitoring daily	14.7	85.3	83.6	16.4	5.972 0.006
Biological monitors (spore tests)					
▪ Verify the sterilization process directly by assessing the killing of known highly resistant microorganisms	16.9	83.1	84.2	15.8	6.788 0.003
▪ Use sterilization biological monitors weekly	13	87	82.5	17.5	5.613

*Significant (P<0.05)

Table (7): Total Practices Scores of Dental Care Providers Regarding Dental Instrumental Reprocessing (n =177).

Total practices	Total practice of dental care providers pre and post program				χ^2 P
	Pre		Post		
	No	%	No	%	
Total Practice levels:					
➤ Satisfactory (>60%) (0 - >24)	28	15.8	136	76.8	39.697 0.001*
➤ Unsatisfactory (<60%) (<24- 40)	149	84.2	41	23.2	
Total Practice scores:	0-40		0-40		
Range (0-10)	7.0282±13.950		31.0508±15.796		
Mean ± SD					
Paired t-test	17.932				
P- value	0.0001*				

*Significant (P<0.05)

Table (8): Correlation between Total Scores of Knowledge and Total Score of Practices of the Dental Care Providers Regarding Dental Instrumental Reprocessing (n =177)

Variables	Total Scores of Knowledge			
	Pre		Post	
	Paired t-test	P	Paired t-test	P
➤ Total score of practice	4.689281	0.001*	19.095	0.001*

*Significant (P<0.05)

Table (9): Correlation Between Dental Care Providers Socio-Demographic data with Their Post Total Knowledge Score and Practices Score Regarding Dental Instrumental Reprocessing (n =177)

Variables	Total Score Knowledge				Total Score Practice		
	Poor %	Fair %	Good %	χ^2 P value	Satisfactory %	Unsatisfactory %	χ^2 P value
Age							
• 20 : >30	4	14.7	35.6	2.222 0.695	24.4	11.9	0.069 0.001*
• ≤30: >40	1.7	11.3	30.5		33.3	10.2	
• ≤40	0	1.1	1.1		1.7	0.6	
Educational level							
• Diploma	1.7	9.6	41.8	15.94 0.001*	42.4	10.7	1.076 0.589
• Institute	0	4	7.3		9	2.3	
• University	4	13.6	18.1		26	9.6	
Gender:							
• Male	1.7	6.8	28.8	4.905	30.5	6.8	1.174
• Female	4	20.3	38.4	0.086	46.9	15.8	0.353
Family income							
• Sufficient	0.6	9	23.2	2.513	26	6.8	0.18
• Insufficient	5.1	18.1	44.1	0.219	51.4	15.8	0.707

*Significant (P<0.05)

III. Discussion

The dental care providers in private dental clinics should be trained about true dental reprocessing procedure so that; the community health nurse should be interested to train them about ideal procedure of reusable dental instruments. Concerning the reusable dental instruments it is important to control processes and procedures used to minimize risk of cross infection between patients [14].

The present study aimed to evaluate the effects of applying instrumental reprocessing procedure for dental care providers in private dental clinics at Helwan District. The current study finding showed that, more than half of dental care providers aged from 20 to less than 30 years, this finding is in accordance with that of Kimberly et al [15] who studied "Oral health beliefs and behaviors of nurse and nurse practitioner students using the HU-DBI inventory: An opportunity for oral health vicarious learning" at Indiana, and mentioned that 53% of studied sample aged from 23 to 32 years. The present study also showed that 53.3% of studied sample was diploma education, while 62.3% of them are female, and more than two third of them had insufficient monthly income. These results are in the same direction with [16] who studied "Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report

study" applied at Saudi Arabia, reported that 55% of studied sample was secondary school education and less than of two thirds of them were female, also 67% of them had insufficient income according to the Ministry of Health salary.

The current study also cleared that, the studied sample correct knowledge regarding dental instrumental reprocessing showed in their knowledge post program than pre with highly statistically significant differences. These results were disagreeing with those of Ibrahim [17], who studied " Cross-infection and infection control in dentistry: Knowledge, attitude and practice of patients attended dental clinics in King Abdul Aziz University Hospital" in Jeddah, at Saudi Arabia, who reported that absence of studied participants' knowledge improvement, while the present study at the same line with [18], Sarfati et al. in their study a "Human-simulation-based learning to prevent medication error: A systematic review" in France which, showed that, the studied sample was improved their knowledge post program than pre, with highly statistically significant differences.

Regarding the studied sample total score knowledge, the current result study displayed that, majority of studied sample had poor total knowledge score preprogram, while minority of them had poor total score knowledge post program, also the present study showed that, total mean knowledge score preprogram was 2.096 ± 1.171 , while post total mean score knowledge was 8.00 ± 1.478 with highly statistically significant differences. These findings were corresponding with those of Coopersmith et al. [19], who studied "Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit", who observed an improvement of studied sample's total score knowledge after program than before.

Concerning to dental instrumental cleaning, the current study results showed that before program minority of studied sample was an instrumental cleaning instruments at beginning of instrumental reprocessing, while majority of them done this step, with statistically significant difference. This result was congruent with that of Baxter et al. [20], who studied "Surgical instrument decontamination: Efficacy of introducing an argon: Oxygen RF gas-plasma cleaning step as part of the cleaning cycle for stainless steel instruments and found obtained that, 80% of studied sample use cleaning step after program. In this point, the researchers referred improvement of studied sample's reported practices to an improvement in their knowledge.

As regards dental instrumental disinfected step, the present study finding cleared that minority of the dental care providers was using this step before program, while post program majority of them used this step, with highly statistically significant difference. This result was harmonious with that of cands [21] who studied "Influence of cleaning in sterility of silicone tubes: A quasi-experimental study" Brazil, and cleared the importance of dental instrumental disinfected step, also showed that 81% of studied sample use dental instrumental disinfectant step preprogram, while 92% of them apply this step post program.

Related to dental care providers' practices for wrapping of dental instruments, the current study result showed that pre intervention minority of them was wrapping dental instruments, while post programs majority of them was doing this step with statistically significant difference. This result in agreement with that of Mehtar [22] who studied "Infection control practices in public dental care services: Findings from one South African Province" and Coulter et al. [23] who studied "Autoclave performance and operator knowledge of autoclave use in primary care: A survey of UK practices" also Smith et al. [24] who studied "Sterilization of re-usable instruments in general dental practice in British clinics, all of them mentioned an improvement of studied sample toward wrapping of dental instruments post implementation program, with highly statistically significant differences.

The current study result also cleared an improvement of dental care providers' reported practices related to monitoring dental instrumental sterilization post program when compared with pre programs, this results agreement with that of Monarca et al. [25] whose study entitled "Evaluation of environmental bacterial contamination and procedures to control cross infection in a sample of Italian dental surgeries", and Smith et al. [26] who studied "Management of infection control in dental practice", also Rutala and Weler [1] study entitled "Draft guideline for disinfection and sterilization in healthcare facilities" in Atlanta" all of them showed that an enhancement of studied sample practices related to monitoring dental instrumental sterilization after program. This studies results disagree with that of Qudeimat et al. [27] who studied "Infection control knowledge and practices among dentists and dental nurses at a Jordanian university teaching center" and found that the studied sample had good practices toward monitoring dental instrumental sterilization preprogram and still good post program.

The present study finding also showed an improvement of dental care providers' total score reported practices toward dental instrumental reprocessing procedure steps post program, with highly statistically significant differences when compared with pre intervention. This result us congruent with that of Lin et al. [28] who "Critical care nurses' knowledge, attitudes and practices of oral care for patients with oral end tracheal intubation: A questionnaire survey" which showed an improvement of studied sample's total score practices after program, with statistically significant difference. When compared with preprogram interventions

Considering correlation between total knowledge score and total reported practices score post program, the current study displayed that positive correlation was found with highly statistically significant differences regarding dental instrumental reprocessing post program. This result was corresponding with that of Rahman et al. [29] who study

entitled "Knowledge and practices of infection control among senior dental students at College of Dentistry, University of Sharjah in the United Arab Emirates" which revealed that, a positive correlation was detected between total score of knowledge and total score of practices post program, with highly statistically significant difference. It means that dental care providers should be acquainted with suitable knowledge related to dental instrumental reprocessing to improve their practices.

The study results revealed that a positive correlation between dental care providers' socio-demographic characteristics with their post total knowledge score and total practices score regarding dental instrumental reprocessing, this result agreement with Smith et al. [24] who showed an improvement in studied sample total knowledge score post program.

IV. Conclusion

In the light of the study findings, it can be concluded that dental care providers' knowledge and practices were improved, utilization of applying instrumental reprocessing procedure for dental care providers working in private dental clinic succeeded in achieving significant improvements in dental care providers' knowledge and practices regarding instrumental reprocessing. As well there were positive correlations between dental care providers' total knowledge, total practices and socio-demographic data after applying the instrumental reprocessing procedure.

V. Recommendations

Based on the findings of the result study, the following recommendations are suggested:

- (1) Applying training program about dental instrumental reprocessing should be compulsory to dental care providers working in private dental clinics and should be updated regularly to improve their knowledge and skills.
- (2) Further studies are necessary in other areas especially rural and slum areas to implement instrumental reprocessing procedure for dental care providers in private dental clinics.

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