Libyan Journal of Science & Technology 9:2 (2019) 194–197

Faculty of Science - University of Benghazi

Libyan Journal of Science & Technology

journal home page: www.sc.uob.edu.ly/pages/page/77

# Sterilization versus disinfection of the dental handpieces (pilot study)

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## Highlights

- **The dentists are responsible for the protection of their patients from cross-infection risk.**
- **The cross-infection policy guidelines should be followed in the correct manner**
- **The autoclaving sterilization is a mandatory procedure to get handpieces free from contamination**

ARTICLE INFO

*Article history:*
Received 17 February 2019
Revised 13 August 2019
Accepted 15 August 2019
Available online 18 August 2019

*Keywords:*
Handpiece (HP), Culture growth (Cg).

ABSTRACT

Improperly following the cross-infection policy can transfer infection from infected patients to others. The Handpieces are the most important workhorse devices properly in all dental procedures. A retro-contamination may occur through their use of a septic environment. Unaware dentists could reuse a contaminated dental handpiece only after wiping with disinfectant.

**Objectives**: To evaluate the infection control status of the wiped handpiece. Moreover, to increase the awareness of dentists toward this issue.

**Methods**: Ten contaminated Handpieces were collected from the dental clinic. They swabbed from their external and internal surfaces and cultured in two types of growth culture media. Next, they were wiped (with InstruPlusForte Sol), swabbed and cultured again. In the last step, the handpieces were sterilized and swabbed for culturing in the same manner.

**The results:** The wiped Handpieces showed that only three (30%) had no bacterial growth from their external surfaces, While 100% revealed the bacterial growth from their internal surfaces. No growth with sterilized Handpieces was demonstrated.

**Conclusion:** Wiping the outside of the handpiece with disinfectant does not eliminate the potential cross-infection risk.

## 1. Introduction

The mouth contains bacteria and viruses from the nose, throat and respiratory tract. The saliva is of particular concern during dental treatment because frequently is contaminated with the blood. Methicillin-resistant Staphylococcus aureus (MRSA) is resistant to common antibiotics. As a result, the infections caused by these organisms are difficult to treat. MRSA colony was found in the nose, axillae and perineum, and abnormal skin as well as in the oral cavity. Therefore, any dental procedure that has the potential to cause contamination with organisms from some or all of these sources. Moreover, failure to adequately clean, disinfect and/or sterilize dental instruments "contaminated with pathogenic organisms from a previous patient will endanger the subsequent patient. This route of pathogenic microorganisms transfer is known as cross-contamination and the resulting infection is referred to as cross-infection (Carmenelena *et al*., 2002; Australian Dental Association 2012). In addition to that, one study confirmed that a cluster of 5 cases of acute hepatitis B virus infections was reported among patients of a two-day, receiving dental in West Virginia clinic. However, through the virus molecular sequencing from those acutely infected patients are identified. None of these cases were reported behavioral risk factors for hepatitis B (Jennifer *et al*., 2016).

## 2. Retro-contamination of handpieces

The Handpieces are the most important workhorse systems in the dental work representing a significantly vital role in any dental practice procedures. Since the head of the HP is running in an aseptic environment, a retrocontamination and internal soiling of the HP occurs, This contamination takes place at the different levels of their internal and external parts (Offne *et al*., 2016). However, the contamination of the internal handpiece surface can spread through the engine to the air/water pipes reaching the entire unit waterline were subsequently can then constitute a secondary reservoir of microorganisms aggregating in biofilms. These biofilms could potentially grow from microorganisms that come from the mouth of patients to the general water supply network. Furthermore. This contamination can lead to serious infection forms. So that, flushing for 2 minutes in the morning and for 20-30 seconds between patients should be considered the daily dental procedures, and longer flushing is suggested after weekends. In the case of using storage tanks, they should be frequently washed and disinfected, filled with distilled sterile water (Sagar & Ramesh., 2013).

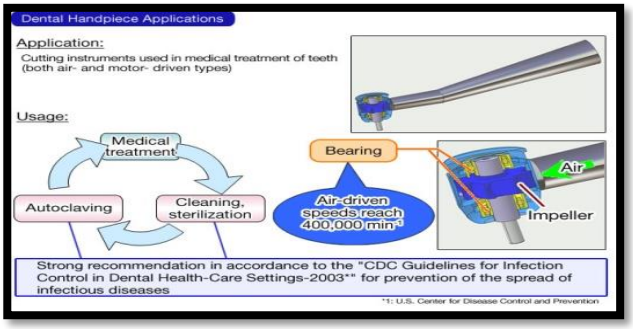


**Fig 1.** (CDC) in its Guidelines for Disinfection

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### 3. Objectives of the study

Up to now some of the dentists could be re-using contaminated dental handpieces only after wiping them with a disinfectant, for that this study was done to see the contamination of the external and internal surfaces of disinfected (an autoclaved) dental handpiece through swab culture procedure.

1-*To evaluate the culture growth from the external and internal surfaces of (unautoclaved) wiped handpiece through a swab.*

2-*To increase the dentists' awareness of the cross-infection policy.*

### 4. Material and method

A collection of ten contaminated Handpieces (used for only one patient) from the private clinic was done in the present study. Each handpiece was swabbed from the external and the internal surface with a suitable sterile cotton swab. A sterile cotton swab was used to touch the external surface of the handpiece shank through several strokes to collect any bacteria for a microbiological culturing.

**Fig. 2.** Swabbing the external surface of the handpiece

Then, with another suitable size sterile swab the same procedure was done, but from the internal surface (bur opening presents in the hopes head and the connecting end of the dental unit.

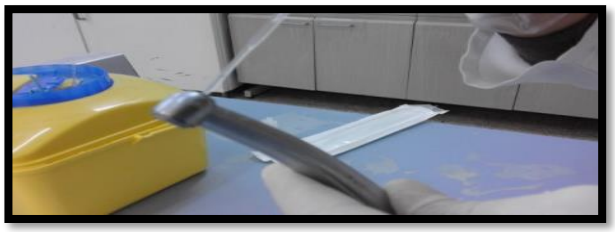

**Fig. 3.** Swabbing the internal surface of the handpiece

The swabbed material was implanted into two cells-culture dishes containing (chocolate and blood) culture ager media. The cell-culture dishes providing with two halves (one used to culture from the external surface of the handpiece. While, the second used for the internal surface). All Petri dishes containing the collected swabs were incubated into the incubator for 24 hours.

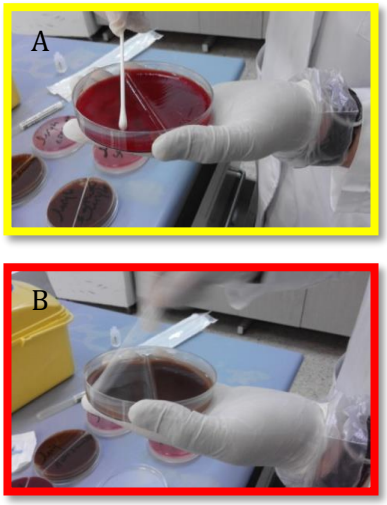


**Fig.4.** (A, B) culture dishes implantation (chocolate and blood) culture ager media.

**Fig. 5.** The samples in the incubator

Next, the ten contaminated Handpieces were wiped with Instru-PlusForte Sol as usual as done in some dental clinics. Then the previously mentioned procedure of the external and the internal surface swabbing was performed.

### 5. Instru plus forte disinfectant

It is a highly effective instrument disinfectant based on acetals and aldehydes (but without formaldehyde) can be used for dental instruments, Active ingredients 100 grams: contain 5,75 form acetate, 8,00 g glutardialdehyde (pentlandite). Surfactants, corrosion inhibitors, preservatives, PH-value regulator. It is Bactericidal, fungicidal, tuberculocidal (3% 5 min), Virus-inactivating (incl. HBV/HIV, 3% 5 min), against all covered viruses: HCV (1% 15 min) and Vaccinia (1% 15 min) effective against all uncovered viruses: Polio (3 %30 min), Adeno (1% 15 min). Herpes Simplex Virus, SV40 (2% 15 min), Instru plus forte is tested according to the standard methods of the (German Society of Microbiology and Hygiene), (www.schumacher-online.com). In the last step, the handpieces were sterilized, in an autoclave in the right way following the stranded procedure. Each sterilized handpieces was swabbed from the external and from the internal surface and cultured in a similar manner.

### 6. Results

First of all, there was no difference in the cultural growth either on the blood agar media or on the chocolate one. However, it was almost the same. The bacterial culture growth was evaluated semi-quantitatively.

**(-): No** bacterial growth.

**(+)**: **Low** the bacterial growth less than 50% of the experimental Petri ditch whole area.

**(++)**: **Medium** the bacterial growth from 50% and less than 75% of the experimental Petri ditch whole area.

**(+++): Heavy** the bacterial growth by more than 75%.

The results of the study were:

1. The bacterial culture growth from the contaminated handpieces (before wiping) revealed that the samples of the external surface were too heavy (+++), too low (+) and six medium (++) growth. While from the internal surface the culture growth was as four heavy (+++) and six medium (++).
2. The bacterial culture growth from the contaminated handpieces (after wiping) showed that the samples of external surface three-nil (-), six low (+) and one medium (++) growth.

Moreover, there was no sample free from culture growth (-) from the internal surface of the handpieces one (+++), four (+), five (++).

3. No culture growth was found from the external and internal surfaces of headpieces after the sterilization step.

**Table 1**

The growth culture before wiping **the handpices**:

| Sample № | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| External surface | ++ | +++ | ++ | +++ | + | ++ | ++ | + | ++ | ++ |
| Internal surface | +++ | ++ | ++ | ++ | ++ | ++ | +++ | ++ | +++ | +++ |

**Table 2**

The growth culture after **wiping the handpices** with Instru Plus Forte So

| Sample № | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| External surface | + | ++ | + | + | - | + | + | - | - | + |
| Internal surface | ++ | +++ | ++ | ++ | + | ++ | + | + | + | ++ |

**Table 3**

The growth culture after the handpices sterilization

| Sample № | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| External surface | - | - | - | - | - | - | - | - | - | - |
| Internal surface | - | - | - | - | - | - | - | - | - | - |

The data were analyzed using a nonparametric test that is (Wilcoxon signed-rank test). This test is similar to the paired Student's t-test, the signed-rank test takes into account that the two treatments are being assigned to the same subject. The test is based on the difference in the measurements within each subject. Since the P-value is (0.046, 0.003) ≦ 0.05, i.e., that is a significant difference.

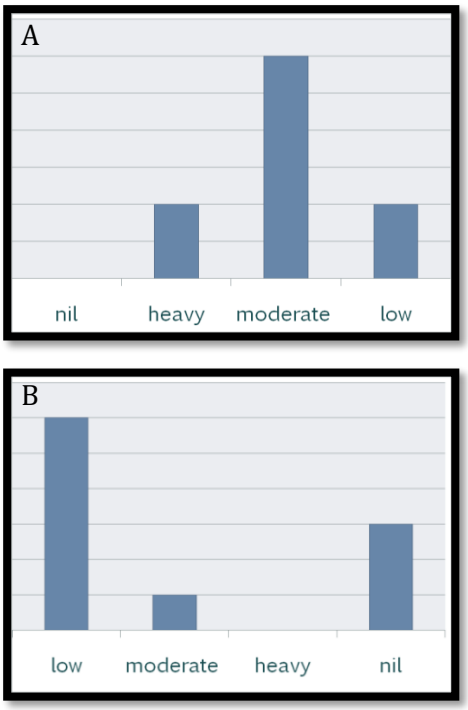


**Fig. 6.** A before, B after the Graphic representation of the External surface swab culture before and after wiping

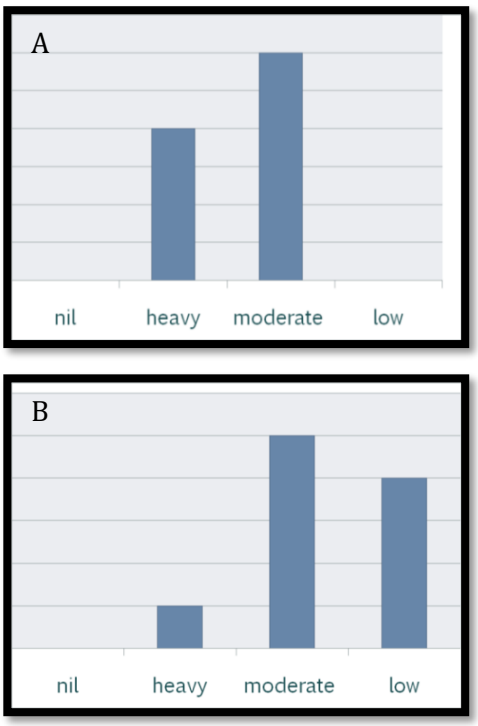


**Fig. 7.** A_before, B after the Graphic representation of the Internal surface swab culture before and after wiping

## 7. Discussion

The results of the present study found out that the external surface of the handpiece culture growth from the swabbed wiped could be nil 30%. While, the results from the internal surface could be nil unless they **were autoclaved which** agreed with previous studies (Hauman, 1993; Judith & Chin, 2006). Furthermore, emphasizing on that the cold sterilization." For practical purposes, there they have no place in dentistry (Redd *et al.*, 2007; Smith & Smith., 2014).

In this study, the explanation of free external surface contamination of swabbing wiped handpiece may be due to the variation in the number of microbes from one patient to another which could be disappearing with using the high-level disinfectant. In addition to that, the wiping method plays an important role. As it is supposed to be using several wipes and not one for all parts of the surface. A wipe is used to clean any blood or debris from the surfaces. After this, a new wipe is used to reapply the disinfectant to the same surfaces in order to clean, and then disinfect. The use of one wipe on multiple surfaces may result in the cross-contamination of surfaces (Offne *et al.*, 2016). Other factors that should be considered include contact time. Moreover, the direction of the wiping is assumed to be in one-direction from up to down. Otherwise, the microbes are transported from one side to another and reintroduced in another way on the surface. Most importantly, the wiping material is a disinfectant and not sterilant. But, with high-level disinfectant, we still found heavy and medium swab culture growth from the internal surface of the handpiece (Michael., 2008). The decrease of bacterial growth from the internal surface could be attributed to that the ability of a disinfectant to penetrate the accessible paths of the internal surface and lack of accessbility to the narrow and twisted one. For the complexity installation and the lack of access of disinfectant to the inner parts of the handpiece there was no internal sample (after wiping with disinfectant ) had nil swab culture growth which as it's known for us that the handpieces are coupled with narrow pipes bringing air and water during the drilling. So that logically any contaminate materials could be pushed from the outward to inward working surfaces and we can never immerse the handpieces in disinfectant solutions, which will cause their corrosion.

**What is the correct method to sterilize dental Handpieces?**

1. *The handpiece should be clean from the outside with detergent and water never immerse it in disinfectant solutions or the ultrasonic cleaner.*
2. *The lubrication with pressurized oil for the recommended period and the excess oil should be clean off for maintaining goal must be performed.*
3. *The sterilizing in an autoclave and run the handpiece briefly before use to clear excess lubricant. After sterilizing, Handpieces must be stored in* a way to prevent their contamination. They should not be fitted to the **dental unit until the time of use in a patient's mouth.**

**Is Disposable *Handpiece* an alternative solution?**

A single-use device also called a disposable device, is designed to be used on one patient and then discarded.

*Advantages*:

1. *They do not need sterilization.*
2. *They are maintenance-free, one-time use.*
3. *More predictable performance than age handpiece, new hand-pick every time.*
4. *The dentist feels nice tactile sensation, lightweight construction.*

*Disadvantages*:

1. *More cost, new hand-picked for every patient.*
2. *Increased waste generation.*

This is to notify you that the Food and Drug Administration (FDA) recommends that reusable dental Handpieces must be sterilized after use. The chemical disinfection is not recommended fact sheet entitled HIV Transmission in Dental Settings. The American Dental Association and CDC have always recommended that dental Handpieces be autoclaved between each patient use (William *et al*., 2003; Radcliffe *et al*., 2013).

**8. Conclusion**

Integrity is doing the right thing even when no one is looking. While the conscience is the ability of a person to distinguish between what is right and what is wrong. However, which leads to a sense of regret when the things that an individual does are contrary to his moral values and to the sense of integrity. Furthermore, ethics are the rules for deciding correct conduct based on the available information. There are times in our lives when we have to take a stand. Other times the everyday little things make an impact on someone's life. Therefore, using the integrity and ethics in our decision-making in infection control is how each of us can decrease the disaster infection risks in dental care. For many years until now we have known that the number of dentists inadvertently or unconsciously reusing the dental Handpieces without autoclaving them, which leads to a negative impact on their patients' lives. The wiping the outside of the handpiece with disinfectant does not eliminate the potential cross-infection risk. The dentist should not care about the infections on economics ground alone and forget the loss of patient confidence and individual suffering.

**Acknowledgement**

I would like to thank Professor, **Ali El merit** (Faculty of Dentistry, Benghazi University, Libya) for his valuable tips. **Dr. Wafa. Elamari, Dr. Niglia Elhasi** (Lab of the pediatric hospital, Benghazi, Libya,) where the all-experimental steps have performed. Most sincerely, for all of their help, diligence, hard work, efforts and their time spent with me to make this study to go well**.**

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