



TO ASSESS THE MICROBIAL CONTAMINATION OF ORTHODONTIC BUCCAL TUBES, ARCH WIRES AND BRACKETS FROM VARIOUS MANUFACTURERS - AN INVITRO STUDY

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Abstract:

Introduction: Orthodontic fixed appliance therapy is one of the common treatment modes for treating different types of malocclusions. Knowing the micro biota that colonizes the unused orthodontic appliances is important for implementing specific sterilization and disinfection measures before the start of treatment.

Aims and Objectives: The aim of the present study was to assess the microbial contamination of orthodontic Buccal tubes, Arch wires and Brackets from various manufacturers.

Material and Methods: The study included 6 Buccal tubes, 6 Arch wires and 6 Brackets belonging to 4 different manufactures which were divided into 12 specimen groups for microbiological culture. The number of colonies appeared were counted and enumerated in the form of (colony forming unit) cfu/ml and were subjected to SEM analysis for the detection of bacteria.

Results: The results showed highest cfu/ml in American orthodontics (AO) brackets accounting for 08 cfu/ml, 04 cfu/ml in 3M Arch wires and 02 cfu/ml in AO Buccal tubes, the remaining samples did not show any colonies.

Conclusion: Hence study highlights the need for manufacturers to state the sterility of their products and for practitioners to ensure the sterility of materials before use and not to assume that all items are sterile.

Keywords: Sterilization; Orthodontic Buccal tubes, Archwire, Brackets, Microbial contamination.

Introduction

In a survey conducted on the various specialty practitioners of the dental faculty, based on the risk of contracting hepatitis, orthodontists were the second highest among the group in contracting hepatitis because, sterilization, asepsis and universal precautions to prevent infectious disease transmission were often neglected in dental practice.¹

More microorganisms are found in the oral cavity than in any other part of the body. So, in dentistry for preventing the spread of infectious diseases sterilization techniques are more important.² Infectious diseases include oral and respiratory infections such as tuberculosis, blood-borne infections, and air- and dust-borne infections.³

According to Thompson and Bogues the orthodontic instruments and materials are sterilized by following methods. The methods in descending order of usage are chemical disinfection, steam autoclave, wash and scrub only, hot-air oven, central sterilization, and flaming in alcohol.⁴

The risk of cross infection is difficult to assess because the oral cavity carries many types of infective agents.⁴

Considering the fact that the rate at which newer strains evolve with time and older strains develop resistance, it has become a constant challenge through time and in the years to come.

Sterilization is a process by which an article, surface or medium is freed of all micro-organisms either in vegetative or spore state.¹ Disinfection refers to the destruction of pathogenic microorganisms only and often applied to procedures which are incapable of destroying spores and certain resistant pathogenic microorganisms such as tubercle bacilli and hepatitis viruses.⁵

The ideal regimen for sterilization includes the following requirements:⁶ A) Prevent transmission of microbial pathogens from one patient to another. B) Require a minimal amount of time. C) Leave instruments undamaged. D) Sterilize a wide assortment of instruments

Lucas et al⁷ have demonstrated that orthodontic treatment procedures can cause bacteraemia by aerobic and anaerobic bacteria.

Orthodontists do not perform oral surgery, but come in direct contact with blood and oral fluids of healthy patients or infectious diseases patients when placing or removing fixed appliances. Hence both patient and practitioner have a substantial risk of spread of infection like hepatitis B, pneumonia and HIV because of the nature of oral environment which is rich in diverse aerobic and anaerobic bacterial flora.⁸

Orthodontic buccal tubes used in orthodontic treatment are attached to the molars but come in contact with intact mucous membranes. Sometimes they lacerate the mucosa and cause injury. The design of the buccal tubes and their various welded attachments present potential areas for bacterial adherence. Therefore, these buccal tubes, archwires and brackets can be considered as semi-critical medical instruments that require a high level of disinfection which can be achieved primarily by high heat treatment such as autoclave or irradiation, with the aim of destroying all forms of microorganisms to reduce the introduction of or spread of infectious diseases.⁹

Although the dental literature presents an abundance of studies on microbial adherence onto orthodontic appliance and utilities, none of the studies have looked into buccal tubes, brackets and archwires that are new from the manufacturer. Therefore, this study was designed to ascertain the sterility of new buccal tubes, archwires and brackets and also to identify the presence of any pathological microorganisms.

AIMS AND OBJECTIVES

The aim and objective of the study is to test the sterility of the new orthodontic buccal tubes, arch wires and brackets received from various manufacturers.

MATERIALS AND METHODS

This study was done to assess the microbial contamination of orthodontic buccal tubes, arch wires and brackets from various manufacturers. The study included six buccal tubes, six arch wires and six brackets belonging to four different manufactures i.e, American orthodontics, 3M Unitek, Ormco, Ortho organizers accounting to a total of twenty four buccal tubes, twenty four arch wires and twenty four brackets. This sample was divided into 12 specimen groups for microbiological culture which is described in the table below [Table 1].

The buccal tubes and brackets were taken from sealed packets provided by the manufacturer and were incubated in sterile tubes, arch wires were incubated in petri plates containing 5ml of saline for 5 minutes [fig.1, fig.2] The resulting saline was subjected to serial dilution of 10^{-3} . LB broth of Bio World Company and agar of Lennox Company were used for microbial culture. The diluted saline solution

was incubated at room temperature for 24-48 hrs. The number of colonies appeared were counted and enumerated in the form of cfu/ml [fig.3] and were subjected to scanning electron microscope (SEM) analysis for the detection of bacteria.

Table 1: Shows 12 specimen groups for microbiological culture.

Sl.No.	Manufacturers	Buccal Tubes	Arch Wires	Brackets
	American orthodontics	06	06	06
	3M Unitek	06	06	06
	Ormco	06	06	06
	Ortho organizers	06	06	06
	Total sample size	24	24	24

Figure 1: Sterile tubes

BUCCAL TUBES SUBMERGED IN SALINE

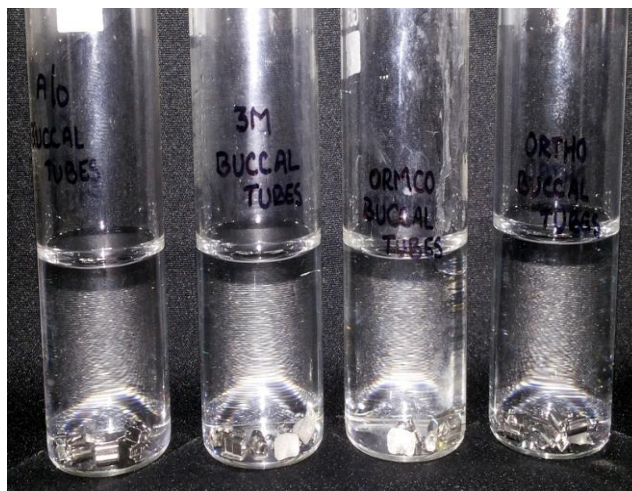


FIGURE 1 a:

BRACKETS SUBMERGED IN SALINE

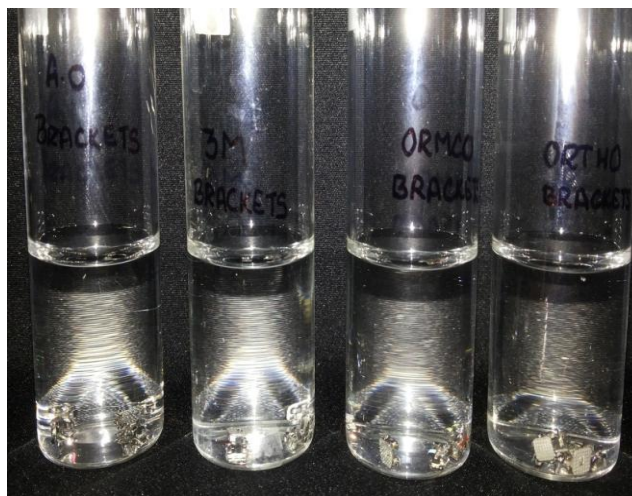


FIGURE 1b

Figure 2: Petri plates

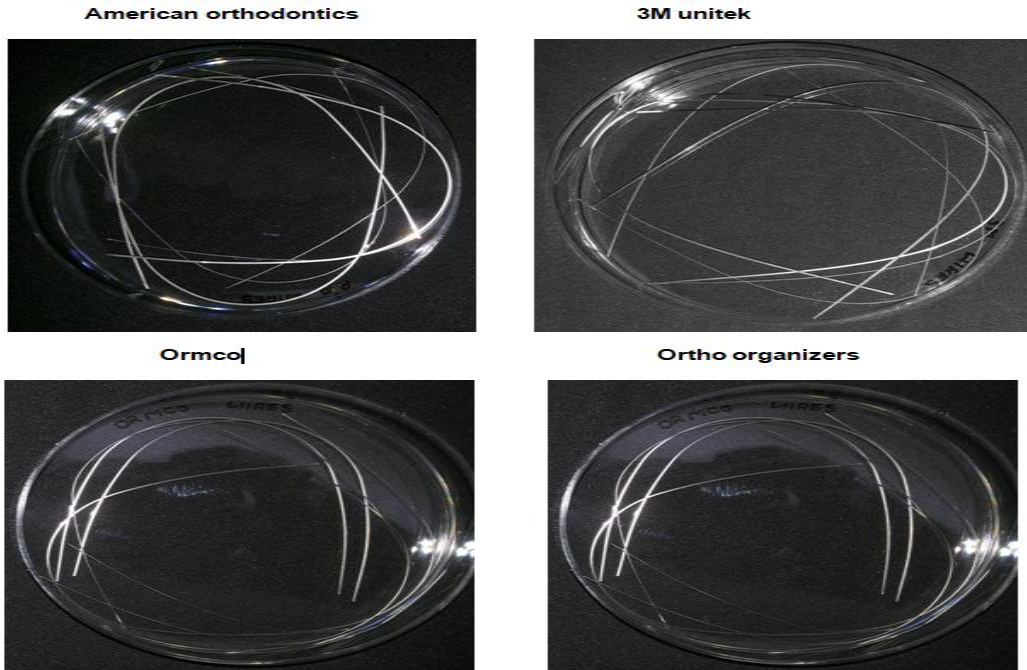
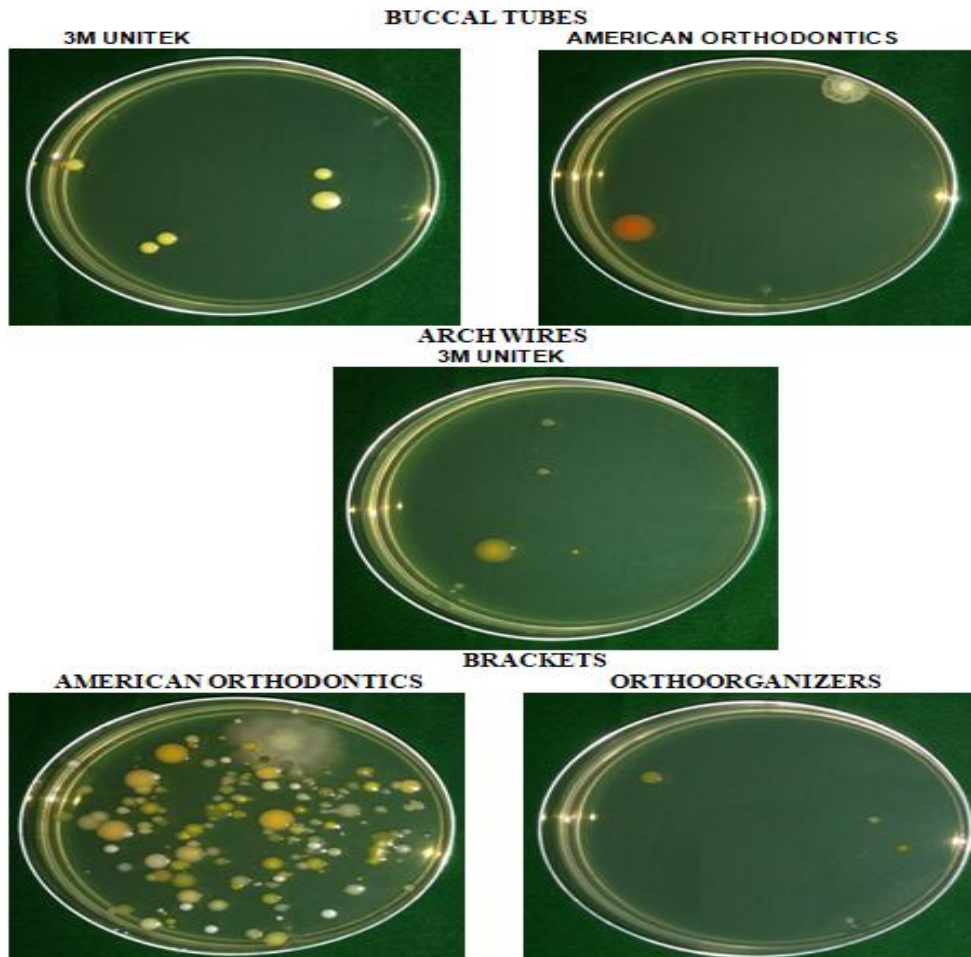


Figure 3: Formation of colonies after 48 hours

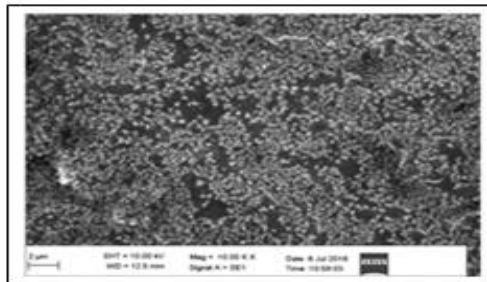
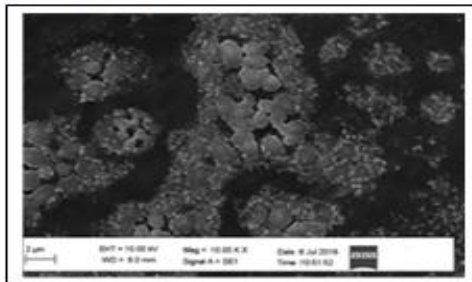


RESULTS

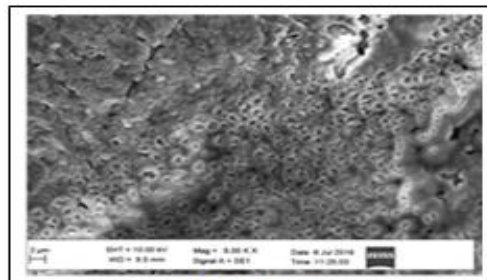
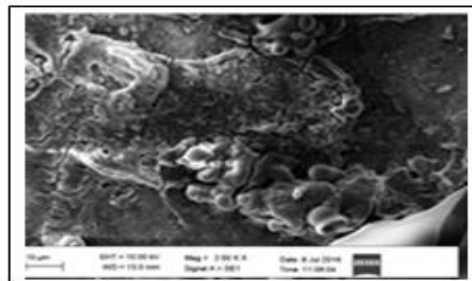
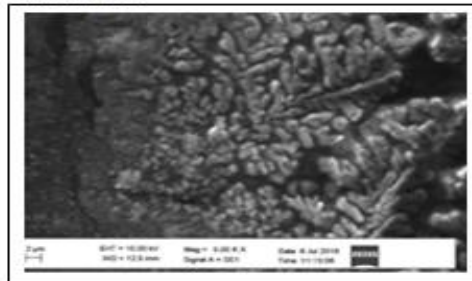
The number of colonies appeared were counted and enumerated in the form of cfu/ml and were subjected to SEM analysis for the detection of bacteria. There were no colonies formed in Ormco buccal tubes, Ortho organizers buccal tubes, AO arch wires, Ormco Archwires, Ortho organizers Archwires, 3M Brackets, Ormco Brackets, whereas highest cfu/ml were seen in AO brackets accounting for 08 cfu/ml. 04cfu/ml were seen in 3M arch wires and 02 cfu/ml were seen in AO buccal tubes [Table 2]. These colonies were subjected to SEM analysis and these colonies revealed predominantly streptococcus [fig.4].

Table 2: Shows number of colonies formed in 10^{-3} dilution

S. No.	Samples	No. Of colonies formed in 10^{-3} dilution
	3M Buccal tubes	05
	AO Buccal tubes	02
	Ormco Buccal tubes	00
	Ortho organizers Buccal tubes	00
	3M Arch wires	04
	AO Arch wires	00
	Ormco Archwires	00
	Ortho organizers Archwires	00
	3M Brackets	00
	AO Brackets	08
	Ormco Brackets	00
	Ortho organizers Brackets	03

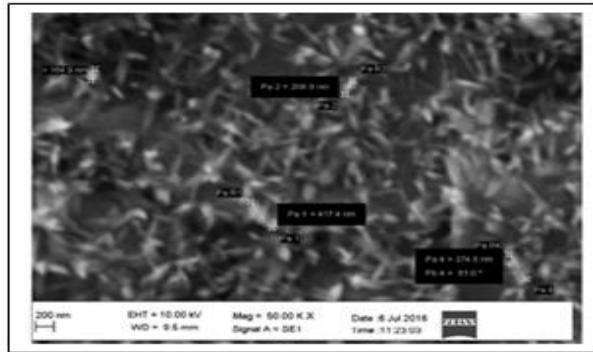
3M UNITEK:**Inference:**

The shape of the bacteria observed is coccus.
This coccus appeared to be monococcus.

AMERICAN ORTHODONTICS:**ARCH WIRES****3M UNITEK:**

Inference:

The shape of the bacteria observed is coccus.
This coccus appeared to be monococcus.

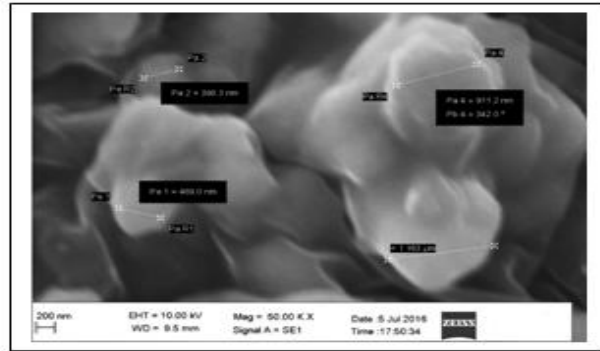
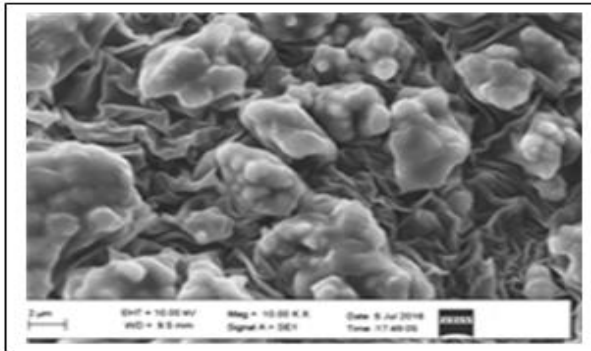


Inference:

The shape of the bacteria observed is bacillus.
This bacillus appeared to be monobacillus.
The diameter of the bacillus ranges from 209nm

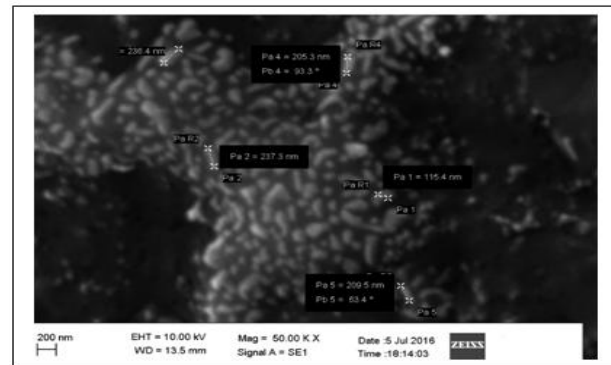
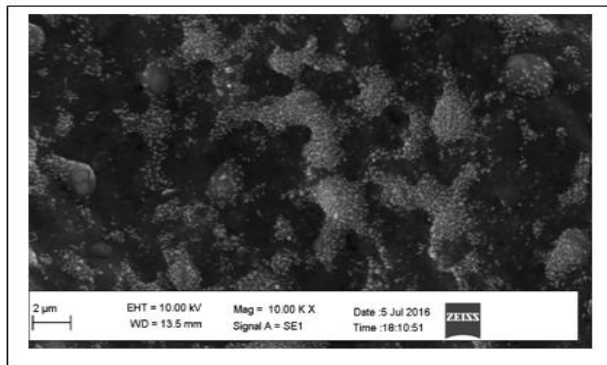
BRACKETS

AMERICAN ORTHODONTICS:



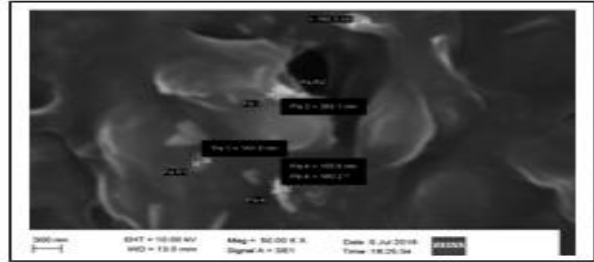
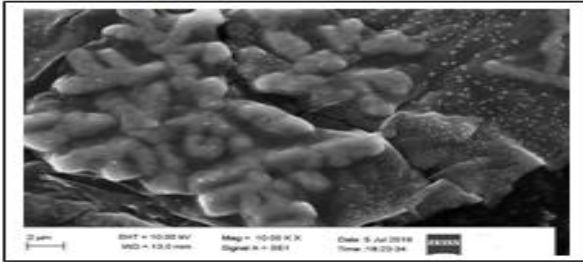
Inference:

The shape of the bacteria observed is coccus.
This coccus appeared to be monococcus.
The diameter of the coccus ranges from 719nm to 901nm



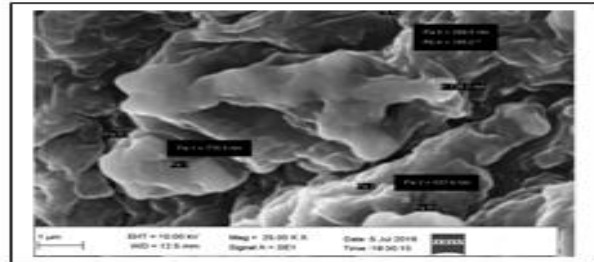
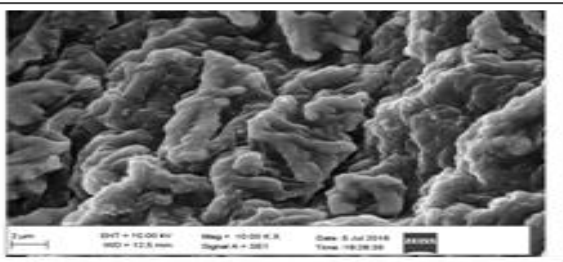
Inference:

The shape of the bacteria observed is bacillus.
This bacillus appeared to be monobacillus.
The diameter of the bacillus ranges from 205nm to 237nm



Inference:

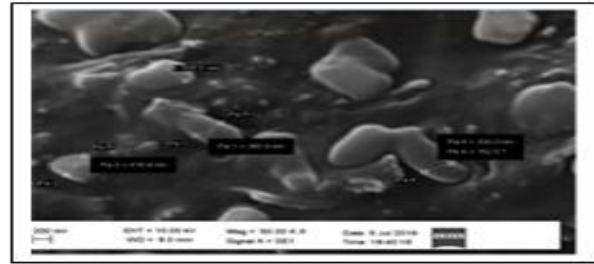
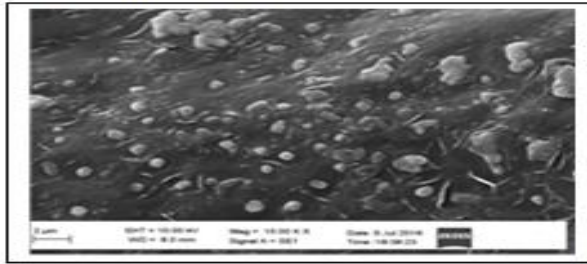
The shape of the bacteria observed is coccus.
This coccus appeared to be arranged in chains (streptococcus).
The diameter of the coccus ranges from 141nm to 263nm



Inference:

The shape of the bacteria observed is coccus.
This coccus appeared to be arranged in chains (streptococcus).
The diameter of the coccus ranges from 399nm to 778nm

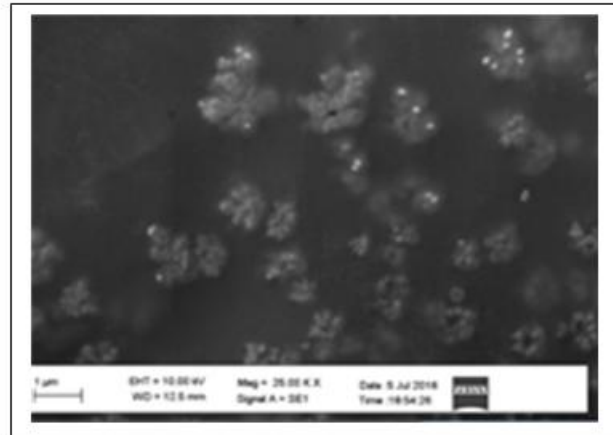
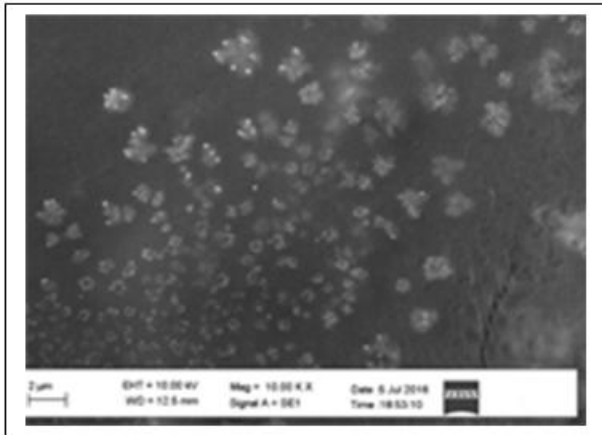
ORTHOORGANIZERS:



13

Inference:

The shape of the bacteria observed is coccus.
This coccus appeared to be monococcus.
The diameter of the coccus ranges from 330nm to 505nm



DISCUSSION

Infection by microorganisms is one of the major concerns for health professionals including the dentists. It is very important to sterilize or disinfect all the materials which are being used in the oral cavity. In orthodontics, several products are available for disinfecting and sterilizing instruments, but there is very little literature available on the microbial contamination of the buccal tubes, brackets and archwires supplied by the manufactures. All these orthodontic materials are attached to patient's teeth and remain in the mouth for 2-3 years. Hence it is necessary to know the amount of microbial contamination of the orthodontic materials which is being used in the patient's mouth. It is also important to assess the potential contamination of these materials so as to determine sterilization protocols and maintain the health of patients and orthodontists.

In the present study, sealed packets of buccal tubes, archwires and brackets were obtained from various manufacturers to know the state of sterility of orthodontic materials which has neither mentioned nor enlisted the state of sterility prior to the usage to the patient. The results revealed that buccal tubes, arch wires and brackets received from manufacturers were biologically contaminated. The results of the present study are in accordance with study conducted by Purmalet al. who also reported biological contamination of the orthodontic buccal tubes.¹⁰

In the present study 3M archwires, 3M buccal tubes, AO buccal tubes, and AO brackets, Ortho organizers brackets were contaminated irrespective of their packing supplied by the manufacturers and not free from bacterial contamination before use in patients, which is in accordance with the study conducted by Barker et al who suggested that new materials "as received" from the manufacturers and those exposed to the clinical environment are not free from bacterial contamination before use in patients.¹⁰

The results of present study are in contrary to study conducted Gerzson et al who evaluated that the microbial contamination of unused orthodontic brackets as received from the manufacturer using microbiological and molecular tests where the results were showed that the bacterial contamination has occurred with Morelli, and Abzil-3M Unitek orthodontic brackets.¹¹

Pandis et al study reveals that *Streptococcus mutans* were present in higher levels in patients with conventional and self-ligating bracket.¹² Whereas in present study bacterial contamination was observed in American orthodontic brackets and Orthoorganizer brackets and no contamination of 3M Unitek and Ormco brackets.

CONCLUSION

In conclusion the results of this study indicate that the potential areas of contamination might cause harm in susceptible patients, such as immunocompromised patients.

During everyday life, we come into contact with many microbes, some with the potential to be pathogenic. In most healthy people, this contact has little effect. This is especially of the oral cavity, which has a well-established oral flora and any additional ingested microbes must compete with the resident microflora to gain a niche before ultimately passing through the gastrointestinal tract. The extent to which the bacteria identified in these studies can have an effect on a patient is currently unknown.

It is also unknown whether larger numbers of environmental contaminants have a greater effect than low levels of potentially pathogenic bacteria, especially among immunocompromised patients. Because of this, it would be wise to reduce the possible risks of using potentially contaminated items with additional pre-sterilization procedures before use.

Clarity on this matter might be obtained from the manufacturers to state the sterility of their items or advise pre-sterilization. This study highlights the need for manufacturers to state the sterility of their products and for practitioners to ensure the sterility of materials before use and not to assume that all items are sterile.

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