Various Disinfecting Methods of Orthodontic Pliers in Daily Clinical Practice: A comparative Study

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Abstract

Introduction: Orthodontic pliers are essential armamentarium in every orthodontic office and should be used once for one patient, then autoclaved before next use. Clinical orthodontics with higher volume of patients, requires a quick chair side disinfection method for pliers, also in rural centres with minimum infrastructure it is a challenge to maintain sterilisation protocols. Various disinfecting agents include alcohols , quaternary ammonium salts, formaldehyde, chloramine, sodium hypochlorite, spirit, glutaraldehyde etc. are available. Out of these we compared the commonly available disinfectants including ethyl alcohol, 5% glutaraldehyde, and 6% sodium hypochlorite to assess their disinfection efficacy after clinical use.

Materials and method: 20 orthodontic pliers were inoculated with Coagulase negative streptococci. The pliers were divided in 4 groups with 5 pliers in each group. Each group was subjected to different disinfectant solution with one group aiding as control. The disinfectants used were: spirit (group 1), 5% glutaraldehyde (group 2), 2% sodium hypochlorite (group 3) and distilled water (control group).

Results: spirit and 5% glutaraldehyde have shown to be potent disinfectants.

Conclusions: Based on these results, we concluded that among the tested methods, disinfection of orthodontic pliers with spirit and 5% glutaraldehyde are the efficient methods for chair-side disinfection.

Keywords: *Orthodontic pliers, Infection, Disinfectants, Disinfection*

Introduction

The practice of General Dentistry, and Orthodontics in particular, is characterized by plethora of patients with variety of infections and contagious diseases transmitted through various modes.(1)

Some orthodontists consider orthodontics as a non-invasive specialty. This thought is an underestimation of risk of contamination that an orthodontist subjects their patients to, the perilous part being most of the orthodontic patients are children and young adults who are easily susceptible to infection. An orthodontist encounters blood in the patient's mouth at an average of ten times a week, which is a significant number to ignore.(2)(3)

The main guide to achieve successful results in infection control is not to disinfect when you can sterilize. Sterilization is the destruction or removal of all forms of life, including spores, while disinfection is the inhibition or destruction of vegetative forms, not destroying spores and some resistant pathogenic microorganisms.(4)(5)

Orthodontic pliers are essential armamentarium in every orthodontic office. Ideally, each set should be used once for one patient and then autoclaved before next use. In order to follow this protocol of sterilisation we require multiple sets of pliers, repeated cycles of autoclaving and huge manpower to handle these procedures.

These protocols can be followed in most private clinical set-up but following these protocols in centres with heavy patient flow and rural setups will be difficult. Clinical orthodontics with higher volume of patients requires a quick chair side disinfection method for pliers.

Inadequate methods of infection control have been adopted in few orthodontic offices, especially the rural set-ups .The main reason for the lag of infection

control in orthodontic is that this procedure takes time and considerable amount of investment. Moreover, the heat or chemical substances damage most of the orthodontic pliers permanently, which are fundamental and invaluable inventory in an orthodontic office.[6]

There is a need to recuperate infection control practice in orthodontic practice, especially when it comes to pliers. Hence, in this study we aimed to evaluate the effectiveness of the commonly available disinfectants including 95% ethyl alcohol, 5% glutaraldehyde, and 6% sodium hypochlorite to assess their disinfection efficacy after clinical use by orthodontists for disinfection of pliers in their daily practice.

Material and Method

The efficacy of disinfection methods on orthodontic pliers used in everyday practice by orthodontists were evaluated, total 20 pliers were selected for the study with 5 pliers in each group. Each group had:

- Pin and ligature cutter

-Distal end cutter

-Weingart plier

-Posterior Band removing Plier

-Bracket positioning plier.

All the twenty pliers were subjected to Dry Heat Sterilisation in Hot Air Oven at a temperature of 250 C for 1 hour.

After the sterilisation was complete, the pliers were contaminated *in vitro* with coagulase negative staphylococci bacteria as this micro-organism is a part of normal flora of oral mucous membrane, is associated with various nosocomial and opportunistic infections, and also is resistant to many antibiotic. Suspension of coagulase negative streptococci was used for contamination of pliers. All pliers were immersed in the suspension for coating it with bacteria. The pliers were then set to dry.

Contaminated pliers were then segregated into their respective groups. Each group was subjected to treatment with one disinfectant as follows:

Group 1: 95 % Ethyl Alcohol

Group 2: 5% Glutaraldehyde

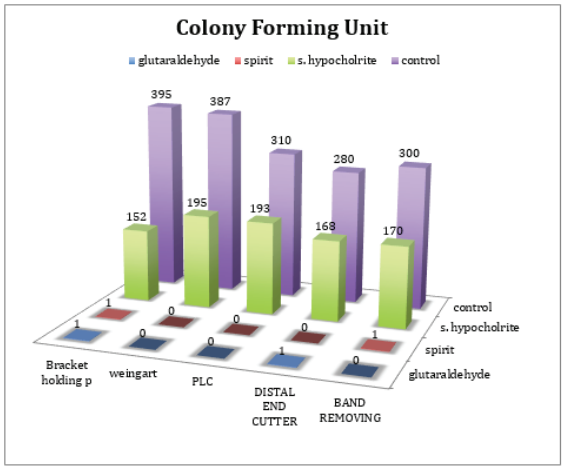
Group 3: 6% Sodium Hypochlorite

Group 4: Distilled water washing (control group)

Each plier was subjected to disinfectant for a treatment time of 2 minutes. Swab was taken from the beak/working end of the plier. The swab was rubbed and cultured on Nutrient Agar and evaluated for the colonies of coagulase negative staphylococcus, incubated at 37degree Celsius for 24 hours.

The effectiveness of disinfection was evaluated by number of Colony Forming Unit on the agar. The colony count was done using a colony counting software named EZEE COUNT. The picture of the incubated agar dish was taken through the app and count was generated.

Result and Statistics



GRAPH 1: The graph here indicates that CFU count is least following treatment with 5% Glutaraldehyde and 95% Ethyl Alcohol (Spirit). 6% Sodium Hypochlorite has shown a high CFU count which indicates its low efficacy as disinfectant.

Discussion

The disinfection methods tested in this study were 2% glutaraldehyde, spirit, 6% sodium hypochlorite and distilled water, which acted as control. Graph-1 shows that 6% sodium hypochlorite couldn't eliminate bacteria completely showing it is a low level disinfectant. It is contradicted by a study done by E. Steve Senia et al. [7] in 1975 who use 5.25% sodium hypochlorite for disinfection of gutta percha cones to eliminate Staphylococcus faecalis, E.coli, Corneybacterium Xerosis and Bacillus subtilis. With 30-seconds exposure all organism except B.subitilis were killed. However, in our study Sodium Choloride failed to eliminate CoNS from the surface of orthodontic pliers. [8] [9] [10] [11]

Spirit proved to be a high –level disinfectant by completely eliminating the CoNS bacteria from the orthodontic plier surfaces. This is in accordance with a study done by Carvalho et al [12], who achieved complete disinfection of rubber toys using spirit. Also, In a study by Klein and Deforest [13] , they concluded that viruses whose coat consists of both protein and lipid were susceptible to a variety of commonly used disinfectants, including spirit, among these lipid-free viruses are such important human pathogens as the polio, Coxsackie and ECHO groups (all enteroviruses) this suggests anti-viral activity of spirit. Similarly, in a study by Earle H. Spaulding [14] , they concluded spirit as effective germicidal, tuberculocidal, and fungicidal and virucidal agent. They also stated that spirit evaporates without leaving a residual chemical on the surface of instrument. This can be advantageous for longevity of orthodontic pliers. [15] [16]

The glutaraldehyde solution is an efficient disinfectant. Graph-1 shows that after the disinfection treatment with 2% glutaraldehyde, the bacteria were completely eliminated from the surfaces of orthodontic pliers. Results of this study showed the efficiency of 2% glutaraldehyde as a disinfectant agent when the objects are immersed for 2 minutes. This result is in agreement with Chapman et al [16], who disinfected rubber toys with the use of glutaraldehyde and Freitas et al [17] who, reported that glutaraldehyde at room temperature is effective in destroying vegetative forms of pathogenic microorganisms, influenza viruses, enteroviruses and tuberculosis bacilli when immersed for 10 to 30 minutes. The authors went further by claiming that glutaraldehyde is effective against highly resistant spores for a period of 6 to 10 hours. The 2% glutaraldehyde solution is chosen for disinfecting instruments. It is the only one who acts in the presence of organic matter.

It is fungicidal, virucidal and bactericidal in 30 minutes and sporicidal at 10 hours. However, it is believed that the 2% glutaraldehyde can destroy vegetative bacteria in less than two minutes and sporulated bacteria in three hours. Myers[19] disagrees, and says that glutaraldehyde is not recommended because the process takes ten hours of exposure, the efficiency is difficult to monitor, and it causes skin irritation, is toxic, discolors and has a corrosive effect on metals.

The need to improve control of infection in orthodontic practice, especially in relation to pliers, is indispensable. It is known that currently, the percentage of adult patients in orthodontic clinics is high, which drops the argument used by orthodontists that patients are very young and therefore have a low risk of inoculation of diseases. Besides, Orthodontics is an invasive specialty, differently from what some orthodontists say.

Conclusion

According to the results obtained from this study, it can be concluded that

a) Treatment with 5% glutaraldehyde and 95% ethyl alcohol is the most efficient of the methods used in this study.

b) 6% Sodium Hypocholrite is a low-level disinfectant and must not be considered as a disinfecting agent for orthodontic pliers.

In day-to-day clinical practice for quick chair side disinfection 5% glutaraldehyde and 95% ethyl alcohol can be used for disinfection of orthodontic pliers in case of unavailability or inaccessibility of sterilizing units.

Ethical Clearance- Not Required

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Conflict of Interest - Nil

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