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A Comparative Evaluation of the Effectiveness of Different Disinfecting Methods Used for Dental Burs

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ABSTRACT

Aim: To compare SEKUDRILL with commonly used disinfectant KORSOLEX with respect to efficacy & the role of pH for ineffectiveness dental burs by evaluating microbial development in culture media.

Materials and methods: The following two disinfectants were used: Korsolex (Bohrerbad), sekudrill (Ecolab). There were four main groups taken as per the

Group 1: 15 drills sterilized by Autoclave
Group 2: 15 drills disinfected by Korsolex
Group 3: 15 drills disinfected by Sekudrill
Group 4: 15 drills served as control in saline

An aggregate of 60 tests, 15 sample for each disinfectant, have been obtained. One function as a control category, which implies that just a microbial count has been calculated without disinfection. Microbial measurement was conducted using a brain heart infusion (BHI) broth and included by plating in the blood agar and MacConkey agar.

Result: The analysis found that the endodontic burs sterilized by autoclave and preserved in sterile pouches at 121 ° C for 15 minutes at a pressure of 15 pounds (Group A) demonstrated absolute sterility. The drills subjected to korsolex chemical sterilization (Group B) showed more turbidity in culture media than sekudrill (Group C). The control group (Group D), which was not sterilized by either procedure, demonstrated turbidity in all the test tubes.

Conclusion: In present study, evaluation of bacterial growth and debris on surface is carried out. The result concluded that sekudrill is better disinfectant than korsolex. The burs which were autoclaved are the most sterile while most of the bacterial growth is encountered in control group.

Keywords: Disinfection, Sekudrill, Korsolex, Turbidity

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INTRODUCTION

Besides over 700 residing bacterial species in the oral cavity of human beings, each individual harbor 100 to 200 species on an average. Not all oral microorganisms are commensals but under certain circumstances some of these become pathogenic causing infections.[1] Infection control is essential because of concern over communicable diseases transmitted during various invasive and noninvasive dental procedures.[2] As per standardized guidelines, dentists are required to sterilize equipment exposed to saliva and blood while treatment. By strictly adhering to universal infection control protocols, one can achieve proper sterilization and prevent spread of infection.[3] In the workplace Infection control may be accomplished across two main types based on whether the treatment interferes with the production of the disease; either it interferes with the dissemination of the disease agent across growing the infection or it eliminates the disease agent after infection has occurred.[4]

Dental burs or drills are utilized in endodontics for different treatments, some of which involve caries extraction, entry cavity preparation and dental planning. Burs may become heavily infected with necrotic tissue, spit, blood carrying potential pathogens and established as a possible vector for cross-infection during such procedures. The small size and complex architecture of instruments like dental drills makes it difficult to Pre clean and sterilize. The fundamental maxim for sterilizing instrument considers that Instruments that have not cleaned effectively cannot be sterilized.[5]

Disinfectants are the compounds that kill pathogenic bacteria from inanimate surfaces. The degree of disinfection obtained depends on the time of touch , temperature, amount and concentration of the active materials, the existence of organic matter, the nature and quantity of the microbial load.[6] Korsolex which is Aldehyde-based disinfectant found to be excellent in infection control while Sekudrill is also used. Thus current study was conducted to evaluate the efficacy of disinfection of two commonly used disinfectants.

MATERIALS

The materials used were Airotor handpiece, transporting medium (phosphate-buffered saline), culture medium (Mc-conkey's agar and blood agar), Brain-Heart infusion(BHI), autoclave(Fig1), Surgical Spirit, 20 Tapered diamond burs (blue color coded and Flat End)(Fig 2), saline, Korsolex

(Bohrerbad), Sekudrill (Ecolab) (Fig3). Corroded dental burs or others with production flaws have been removed. The consent was received from the Institutional Ethics Committee.

FIG 1: Autoclave

FIG 2: Tapered diamond burs

FIG 3: Korsolex (Bohrerbad), Sekudrill(Ecolab)

Table 1: Properties of Disinfectants

Property	KOH(Sekudrill)	Glutraldehyde(Korsolex)
Molecular Wt	56.1	100.13
Specific gravity	2.044	1.129
pH	13.5	6 to 7
Boiling point	1320	188
Melting Point	360	-14
Solubility	119gms	100gms
Concentration	0.5 to 1%	1 to 2%

METHODOLOGY

All 60 drills were autoclaved at first, out of them 15 uncontaminated drills were transferred into sterile pouches. Remaining 45 drills were assigned to 15 different patients randomly for the purpose of access opening. Once they got contaminated with blood and saliva, immediately transferred into three containers containing korsolex, sekudrill, saline (n=15) for 15 mins. Four experimental groups were made as follows:

Group 1: 15 drills sterilized by Autoclave
Group 2: 15 drills disinfected by Korsolex
Group 3: 15 drills disinfected by Sekudrill
Group 4: 15 drills served as control in saline

All the drills were transferred into 60 different culture tubes each containing brain heart infusion broth incubated at 37°C for 24 hours. Subculture was done from all the 60 BHI broth, into one plate of blood agar and one plate of Mac Conkey agar for each specimen incubated at 37°C for 24 hrs. Plates were observed for the presence or absence of growth for 24 hrs & 48hrs.

After 48 hrs, the test tubes have been tested for some turbidity. The appearance of turbidity suggested the existence of microorganism development and that the specific bur was not fully sterilized. Test tubes with turbidity were tested and validated for the existence of microorganisms through observing under the light microscope after the Gram stain and culture examination. The Kruskal-Wallis test was used to assess some major variations between classes. The MannWhitney test was used to show any significant difference between the three agents. The importance point was set at $P < 0.05$.

RESULT

The study found that endodontic burs sterilized by autoclave and preserved in sterile pouches at 121 ° C for 15 minutes at a pressure of 15 pounds (Group A) demonstrated absolute sterility. The quantification of debris on endodontic instruments according to various cleaning procedures as shown in Table 2. The drills subjected to korsolex chemical sterilization (Group B) showed turbidity in culture media as shown in fig 5 & fig 7 after 24 and 48 hrs respectively, while maximum biologic contamination is 7.78 by this method. Fig

4 and 6 demonstrated the growth of microorganisms after chemical sterilization by Sekudrill (Group C) & showed maximum biologic contamination 6.80 (table 3). The control group (Group D), were not sterilized by any method, showed turbidity in all the test tubes and showed maximum biological contamination (fig 8). Statistical study of the four sterilized groups found a statistically important gap between groups in their sterilization performance ($P \leq 0.05$).

FIG 4: Sek 24

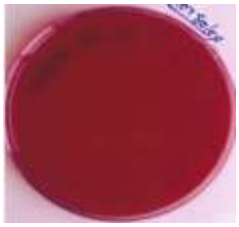

FIG 5: Kor 24

FIG 6: Sek 48

FIG 7: Kor 48

FIG 8: Control

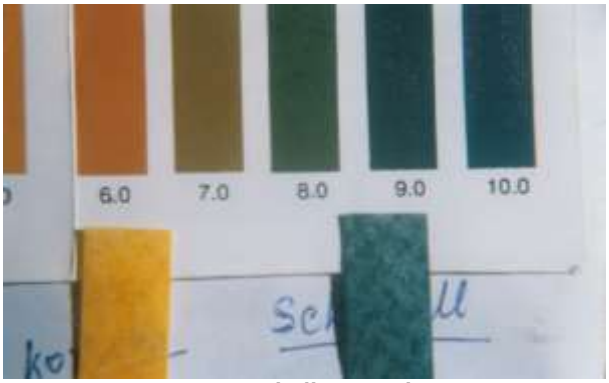

FIG 9: pH indicator strip

Table 2: Amount of debris on endodontic devices subject to different cleaning protocols.

Cleaning score	Group 1	Group 2	Group 3	Group 4
4	-	-	-	15(100%)
3	-	6(40%)	9(60%)	-
2	-	9(60%)	6(40%)	-
1	3(20%)	-	-	-
0	12(80%)	-	-	-
Total	15	15	15	15

Table 3: Representing the mean of gross biological contamination

Group	Mean of maximum biological contamination	Std. Dev	SE of mean	Min	Max	Kruskal-Wallis Chi-sq	Pvalue
1	1.71	1.73	0.26	1	4	175.164	0.001
2	7.78	1.36	0.20	3	2		
3	6.80	1.96	0.29	2	3		
4	10.91	1.51	0.23	0	5		

Litmus color indicator strips dipped directly in the 2 tested disinfectants – matched with pH indicator strips (fig 9). The viable pH for bacterial growth is 6.5 to 7.5. Thus, it is clearly indicated that Sekudrill has the alkaline pH which aids in better disinfection.

DISCUSSION

Dental burs are distinguished as expected vehicle for cross disease in dental hole because of their contact with spit, blood, teeth and bone . While the greater part of the dental instruments are successfully cleaned after use, the precious stone bramble is regularly disregarded and just brushed or inundated in a gentle disinfectant preceding reuse.[7] Dental burs are heavily polluted with necrotic tissue, spit, semen, and possible infections during use. Burs has a complicated design that allows pre-cleaning and subsequent sterilization impossible to accomplish.[8] In a busy private practice environment, it is not feasible to obtain appropriate sterilization outcomes due to incompetence and hurry saving time, insisting a rapid chairside sterilization alternative.

The British Dental Association advises that any portable dental device that comes into contact with oral fluids should be thoroughly washed and sterilized prior to usage.[9].Resterilization is defined as "repeated application of a

terminal process designed to remove or destroy all viable forms of microbial life, including bacterial spores, to an acceptable sterility assurance level."[10]

Whitworth et al conducted a study that compared the efficacy of various methods of precleaning and sterilizing of dental burs by manual cleaning, enzymic agents, and washer-disinfectors and recommended the use of washer-disinfectors for presterilization cleaning of contaminated dental burs.[11] Disinfectants mainly includes Alkalies, Biguanides, Cationic Surfactants, Halogens Chlorine based, Iodine based, Oxidizing agents, Phenols & Related compounds and Reducing Agents. The present study uses Korsolex which is a broad spectrum microbicidal used for disinfection of high risk areas. It mainly contains gluteraldehyde and 1, 6-dihydroxy 2, 5- Dioxahexane with high-tech cleanser and rust inhibitors. Sekudrill mainly contains potassium hydroxide which releases the OH ions and shows synergistic effect with propylene glycol aided in better disinfection.[12]

Fais et al contrasted the cutting power of sterilized carbide burs with microwaves and conventional sterilization methods: dry heat (G1), autoclave (G2), microwave irradiation (G3), glutaraldehyde (G4) or control no sterilization (G5). Dry heat sterilization was the one that had the least impact on the cutting capacity of carbide burs, and microwave sterilization was no better than traditional sterilization. Microwave sterilization is one of the most current technologies of low expense, speed and ease of disinfection[13]. In all previous literature, the methods like manual scrubbing to autoclave sterilization were explained; autoclave was the best method to sterilize the dental burs. But this method is expensive, time consuming, and cannot be implemented in shorter time especially in between patient appointments. Cold sterilization may be a good alternative in case of short time for disinfecting dental burs. However, none of the literature compared the effectiveness of cold sterilization techniques using various disinfectants.[14]

This study revealed the efficacy of korsolex and sekudrills for disinfection of dental burs of daily use. The contact time and quantity of disinfection was standardized as 15 minutes and 2 ml for all disinfectants.[15] When compared to glutaraldehde korsolex showed less biologic contamination.

Glutaraldehyde was classified as a high level of disinfection. It is the most commonly used disinfectant in the dentistry. In vivo study showed that antimicrobial activity of Asporin (2% alkaline glutaraldehyde) required 1 min killing time for almost all instruments. Burs and files sterilized by immersing in glutaraldehyde (2.4%) for 12 hours revealed complete sterilization. However, the chlorine-containing compound was the effective disinfectant against hepatitis B virus than glutaraldehyde, which requires ultrasonication.[16,17]

KOH is classified as an alkaline cleaning agent, which are effective at emulsification and sapponification of fats, protein peptidization, and are efficient at removing soils, greases and oils.[18] KOH can penetrate thick layers of stubborn oil and grease more easily. This makes it ideal for cleaning heavily soiled surfaces. potassium-based products are generally more soluble and allows for more concentrated products. Concentrated products typically have a lower freezing point, which means they are less sensitive to low temperatures.Since dirt that has reacted with KOH is generally much more soluble in water, cleaned surfaces are much easier to rinse.[19]

The theory that the germicidal efficiency of potassium hydroxide(KOH) solutions is largely due to the presence of undissociated KOH, appears to be largely based upon the observation that the velocity of disinfection with KOH solutions is accelerated by the addition of substantial quantities of a neutral salt. The experimental differentiation of the effects of the hydroxyl-ion and the undissociated KOH is difficult. The neutral salts that would suppress the dissociation of the KOH might decrease the resistance of the organisms to the action of the hydroxyl-ions, alter the permeability of the cell wall or exert a pronounced influence upon the ability of the bacteria to adjust the medium immediately surrounding the bacterial cell.[20]

The pH inhibits antimicrobial function by modifying the disinfectant molecule or the cell membrane. Most cleaning chemicals are alkaline in nature, as hydrolysis (saponification), chelation and soil dispersion are generally most efficient at alkaline pH rates. OH ions saponify lipids in the enveloping layer, contributing to the degradation of the surface structure. The pH greater than 10.0 disorganizes the arrangement of peptidoglycan and induces the nucleotide hydrolysis of the genome of the virus.[21] The total improvement in the effectiveness of potassium hydroxide against glutaraldehyde with increasing pH can be clarified by its polycational existence. At physiological pH, positive groups of potassium ions will easily bind to the negatively charged surface of the bacteria. It does causes to the membrane harm and death of the bacteria.[22]

As this study involved less sample size; more sample size and further research are required to compare the level of disinfection between korsolex and sekudrill.

CONCLUSION

Today's era needs rapid chairside disinfectant for acceptable sterilization. Among all the products available in market korsolex and sekudrill are proving their efficacy. In the present study , evaluation of bacterial growth and debris on surface is carried out. The result concluded that sekudrill is better disinfectant than korsolex. The burs which were autoclaved are the most sterile while most of the bacterial growth is encountered in control group.

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