Pulpotomy therapy and contamination of handpieces among children attending the dental hospital.

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ABSTRACT

Background: The purpose of this study to determine the contamination with oral flora when used low speed handpieces for pulpotomy therapy on primary teeth.

Material and methods: Children aged 7 – 9 years attending the dental clinic were examined for 24 pulpotomies on primary teeth from 24 subjects then analyzed microbiologically to detect the extent of bacterial contamination from patients saliva by using brain – heart infusion broth, and blood agar.

Results: Microbial analysis indicated aerobic and anaerobic bacterial contamination at all 3 – sites from all 24 handpieces 100% bacterial and blood contamination. The 3 – sites didn’t have significantly different levels (cfu/ml) at P < 0.001.

Conclusion: These data suggest that the inertial surface of low speed handpieces can become microbially contaminated during use with pulpotomies teeth unless properly sterilized between patients

Keywords: Handpiece, Pulpotomy, Sterilization. (J Bagh Coll Dentistry 2010;22(3):111-114).

INTRODUCTION

The dental handpiece occupies a pivotal role in the armamentarium of the oral health care professional few tools offer the versatility provides by the handpiece. Conversely the breath of procedures and the high frequency of use of the dental handpiece present added infection control management duties to the daily routine of the dental team. (1)

The recommendation from the centers for disease control and prevention is to clean – heat – sterilize handpieces and other intra oral instruments that can be removed from the air and waterliners of dental unit between patient use comes from several studies which demonstrated the potential for internal contaminations during use (2,3).

This offers the potential for cross-contamination of subsequent patients. All contra – angles currently have a vent or opening designed to reduce or eliminate excessive heat build up. This opening or vent could become a pathway for internal contamination from the patients’ saliva, which could lead subsequent cross-contamination unless the low–speed hand piece is heat sterilized between uses (4). The initial in vitro results of these studies show that viable bacteria can be found on the internal and external surface of low – speed hand pieces and that the only way to eliminate the potential for cross-contamination is by heat sterilization.

Bacteria contamination can come from various sources (i.e., saliva and blood), which can pose potential difficulties for dental practitioners. A potentially serious cross-infection problem could occur if the patients’ bodily fluids were to enter the interior surface of a slow – speed dental hand pieces during use. Few studies have been done to determine the potential for internal contamination transfer and the need for the proper sterilization (5,6). To date, only preliminary information concerning the internal contamination of low – speed handpiece system exists (7).

A study conducted by Waskow et al (8) evaluated contamination of the interiors of low – speed handpiece attached to a variety of prophy angles. This study used Serratia marcescens as the contaminated the more recent accepted Geobacillus spore, which has been tested in other studies .This study results again suggested that internal contamination could travel both inward and outward during use.

A recent in vitro study investigated contamination of 2 types of low – speed hand piece attached to 6 different types of disposable prophy angles and 1 type of reusable metal prophy angles (9). Surfaces sampled included the inside surfaces of the prophy angle and the nosecone including the gears and motor .in the 160 tests of handpiece contaminated at the prophy cup end the spores traveled into motor gears 32 times (20%) . This in vitro study suggested that internal contamination of low – speed handpiece motor can occur during use with prophy angles and that emission of internal contamination can also occur.
A study contacted in Japan by Sato et al.\(^{(10)}\) investigated the bacterial – composition of necrotic pulps in human primary teeth the study reported that most organisms present in necrotic pulps were anaerobic.

An in vivo study\(^{(11)}\) used low–speed handpiece motors attached to prophy angles. This study involved 20 human subjects, 2 types of handpiece attached to 2 types of disposable, prophy angles and 1 type of reusable metal prophy angle. Sterile hand piece – prophy angle combinations polished subjects’ teeth for a randomized polishing time of 3, 4 and 5 minute intervals. For each of the 6 combinations of hand pieces and prophy angles, 75% to100% of the 20 subjects system showed bacterial contamination in a least cultured area each, after sampling. Of the 420 sites sampled, 258 (61%) produce bacterial growth. No significant differences existed between any of the 6 handpiece prophy angle combinations these results suggest that clinical use contaminated the internal surfaces of the low – speed handpiece with attached prophy angles. It appears that unless properly sterilized, low speed handpieces could pose a risk for cross – infection

As in 1992, through no epidemiologic evidence implicates the handpiece in disease transmission, a number of studies document the presence of contaminated fluid and the retention of viral DNA inside handpiece compartment, which could be expelled intra – orally during subsequent uses\(^{(12-14)}\).

They found viable bacteria on the handpieces external and internal surfaces after lubrication and disinfection, while heat sterilization via an autoclave machine rendered both external and internal surfaces sterile.

The purpose of this in vivo study was to determine the potential for internal bacterial contamination of low – speed handpiece , this is concern for dental practitioners as a serious issue to prevent transmission of bacterial organisms between patients. So we have an ethical responsibly to maintain the health and safety of their patients.

**MATERIALS AND METHODS**

Through three weeks period (May, 2009), 400 children (6-7) years old attending the dental clinic, department of paedodontology ,college of dentistry of Baghdad for the first time were examined for their dental condition investigation.

This study also conformed with good laboratory and good clinical practices\(^{(15)}\). A study group 24 subject (12 female, 12 male). The control group include 24 sterilized hand piece but not clinically used. They were all fulfilling the following criteria:-

- healthy children with no history of serious illness or chronic system disease .
- had a minimum of ten teeth
- had more than one tooth needing pulpotomy therapy.

All subjects had an existing condition that required pulpotomy therapy on either their primary first or second molars. Subject could have more than one tooth needing pulpotomy therapy. Each procedure, however, required its own handpiece and rubber dam isolation. The only handpiece used was Star Dental Titan 2 – piece low – speed handpiece with a contra–angle head (Dental EZInc, Lancaster). Cleaning and sterilization (steam auto clave for 30 minute at 121C\(^o\)) occurred prior to pulpotomy therapy .after use, each low – speed handpiece / contra angle system underwent microbiologic analysis in the laboratory aseptic disassembly of the low – speed handpiece /contra – angle system occurred first. Surfaces sampled for each low–speed handpiece/contra–angle system included the inside of the nose cone ,gears of the nose cone and gears of motor (Figure 1). Steam sterilized cotton–tipped applicators moistened in normal saline were swiped a cross the entire area of each sit 3 times for 5 seconds. The swabs were then put into tubes containing 2.00 ML of brain – heart infusion broth and overtaxed all these swabs were cultured aerobically , an aerobically . For aerobically the swab streak on brain – heart\(^{(16)}\) infusion agar then is incubated for 24 hours. at 37 C\(^o\). where an aerobically the swab streak on blood agar plate and put it in anaerobic jar with candle which generate CO2 .After incubation, microbial colony counting occurred and was expressed as colony forming units per ml(cfu/ml) . There was also in examination for trace amount of blood contamination. A drop from each specimen tube by detecting hemolysis on blood agar by color developments intensity (melleville and Russell) date processing and analysis were carried out using SPSS package version 10. Analysis of variance and Student's t- test were applied for statistical analysis level of significance (5%), ANOVA test .
RESULTS
The total of number of children involved 24 (12 boys and 12 girls) three subjects had teeth requiring multiple pulpotomy therapy and the remaining 21 has a single tooth in need of pulpotomy therapy. Table 1 and 2 shows the microbiologic analysis showed highly significant aerobic and an aerobic bacterial contamination at all of the 3 culturing sites from each of the 24 tested hand pieces 100% contamination. Table 3 shows t – vales and probabilities of 3 site of contamination which is all of them highly significant. at P<0.00 H.S .figure (2)show the site 1 (the inside of the nose cone) constituted the major part of bacterial contamination while site 3 (gears of low–speed handpieces motor) was the least.

Table 1: Aerobic bacterial contamination (CFU/mL)

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>Mean ±SD</th>
<th>Range (colony forming units per Ml[CFU/mL])</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>24</td>
<td>3871±154.6</td>
<td>3400-4000</td>
</tr>
<tr>
<td>2†</td>
<td>24</td>
<td>345.4±7.211</td>
<td>330-560</td>
</tr>
<tr>
<td>3††</td>
<td>24</td>
<td>308.3±25.48</td>
<td>300-390</td>
</tr>
</tbody>
</table>

*The inside of the nose cone  
†Gears of the nose cone.  
††Gears of the motor

Table 2: Anaerobic bacterial contamination (CFU/mL)

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>Mean ±SD</th>
<th>Range (colony forming units per Ml[CFU/mL])</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>24</td>
<td>6125±111.3</td>
<td>6000-6500</td>
</tr>
<tr>
<td>2†</td>
<td>24</td>
<td>4038±64.69</td>
<td>3900-4200</td>
</tr>
<tr>
<td>3††</td>
<td>24</td>
<td>3188±122.7</td>
<td>3000-3300</td>
</tr>
</tbody>
</table>

*The inside of the nose cone  
†Gears of the nose cone.  
††Gears of the motor

DISCUSSION
Sampling of negative control 24 subjects produced no aerobic or anaerobic bacterial contamination from any of the 3 culturing site . Analysis of clinically used handpiece indicated the presence of highly significant aerobic as well as anaerobic contamination at all 3 sites. Previous studies indicate that most organisms present in necrotic pulp tissues are anaerobic. In this study, however there was no significant difference detected between the numbers (cfu/ml) of aerobic and anaerobic organisms or among culturing sites there were several limitations to any clinical trial. in our study , we were looking for the present or absence of any bacterial to justify sterilization of low–speed handpiece . So this research study only evaluated contamination in one direction, from the external environmental to the inner areas of the hand pieces. Previous lab studies ( 9-11) on low–speed hand pieces. However, it was shown that contamination can occur in the reverse
direction – further emphasizing the need for proper sterilization between patient uses to prevent cross contamination.

So these results support our hypothesis that oral bacterial contamination would be found on internal surface of hand pieces after use so these oral bacteria had possibly to be transmitted to the next patient (9,11). To decrease the chances of cross-contamination, low-speed hand piece/ contra angle system must be properly sterilized using heat between uses. This recommendation would likely increase the cost of operations. Routine sterilization decrease hand piece longevity. Additional hand pieces would be required to meet patient flow demands due to increased handpiece turnaround time (ie, sterilization and repackaging). Routine sterilization would also increase labor costs (18-19).

The general principles of clean, lubricate and according to manufacturers recommendations before sterilization (19-21).

This study melds well with others that indicate the presence of internal contamination and the potential for cross – transmission with clinical use. It also supports the position that requires routine sterilization by heat of low-speed hand piece system, increase of materials and labor costs will be justified because of the potential threat to patient safety and health. So without proper pre sterilization treatment, excess cutting debris, foreign material and lubricant can be backed onto the bearings and other critical surfaces resulting reduce mechanical efficiency, increased friction and early wear of handpiece. The conclusion of this study can be made the internal surface of low-speed handpiece contra- angle systems can became contamination with oral flora during clinical use and the internal bacterial contamination can be contribute to the transmission of organisms between patient if the low-speed handpiece motors component and contra-angles are not heat-sterilized between uses. It highly recommended prolonging the life of the device, lubrication of handpiece with manufacturers recommended lubricant has been shown to enhance sterilization efficacy. All handpieces, attachments and devices shoud be cleand, lubricated and heat sterilized according to manufacturers instructions.

REFERENCES