Revista Odonto Ciência
Journal of Dental Science

ORIGINAL ARTICLE

Rev Odonto Cienc 2017;32(1):47-49
http://revistaseletronicas.pucrs.br/ojs/index.php/fo
http://dx.doi.org/10.15448/1980-6523.2017.1.26482

Open Access

Microbial contamination of retraction cords: an *in vitro* study

Darlene Ribeiro dos Santos Gerzson[a], Edison Maciel Nunes de Souza Filho[b], Everton Ribeiro dos Santos[a], Marina Lucia Cumerlato[c], Alexandre da Silveira Gerzson[a]

ABSTRACT

OBJECTIVE: Dental care has been particularly concerned with sterilization of instruments and materials. In this context, the methods used for infection control are essential to ensure patients' safety. This *in vitro* study aimed to test gingival retraction cords taken from factory-sealed containers for the presence of contamination. Three commercial brands of retraction cords were analyzed: Retraflex®, Pró-Retract®, and Ultrapack®.

METHODS: The sample consisted of 10 1-cm segments of retraction cords of each commercial brand (n = 30). For bacterial growth analysis, 30 test tubes containing sterile brain heart infusion (BHI) as the culture medium were used. Bacterial growth was considered positive in tubes in which the BHI broth became turbid.

RESULTS: Of 30 test tubes with retraction cords, six showed turbidity and were considered contaminated: three tubes with Retraflex®, one tube with Pro-Retract®, and two tubes with Ultrapack®, accounting for 20% of the total sample.

CONCLUSIONS: The present findings showed that some retraction cords received from the manufacturers were contaminated with microorganisms. Thus, extra caution should be taken when using these materials, and further studies should be conducted.

Key words: Equipment contamination; Microbiological techniques; Gingival retraction techniques; Dental materials; Cross infection

[a] Professor, School of Dentistry, Universidade Luterana do Brasil (ULBRA), Canoas, RS, Brazil
[b] Dentist, School of Dentistry, Centro Universitário da Serra Gaúcha (FSG), Caxias do Sul, RS, Brazil
[c] MSc in Orthodontics and Dentofacial Orthopedics, Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre, RS, Brazil

Contaminação microbiológica de fios retratores: um estudo *in vitro*

RESUMO

OBJETIVO: O atendimento Odontológico, de forma geral, é cercado de cuidados no que diz respeito à esterilização dos instrumentos e materiais utilizados. Neste contexto, os métodos realizados para o controle de infecção são fundamentais para a segurança dos pacientes. O objetivo deste estudo *in vitro* foi avaliar a contaminação de fios retratores provenientes das embalagens fornecidas pelos fabricantes. Para isto, foram utilizadas três marcas comerciais de fios: Retraflex®, Pró-Retract® e Ultrapak®.

METODOLOGIA: As amostras foram compostas por 10 segmentos de 1cm de fio retrator de cada marca comercial, perfazendo um n=30. Para a análise de crescimento bacteriano foram utilizados 30 tubos de ensaio esterilizados contendo o meio de cultura BHI (Brain Heart Infusion). O turvamento do meio contido nos tubos indicou a contaminação dos mesmos.

RESULTADOS: Dos 30 tubos contendo fios retratores, seis mostraram turvamento e foram considerados contaminados: três da marca Retraflex®, dois tubos da marca Ultrapak®, e um tubo da marca Pro-Retract®, perfazendo um total de 20% da amostra.

CONCLUSÃO: Alguns fios retratores utilizados nesta pesquisa, apresentaram contaminação por microorganismos. É interessante ter cuidados extras na sua utilização, e mais estudos devem ser realizados sobre o assunto.

Palavras-chave: Contaminação; Técnicas microbiológicas; Técnicas de retração gengival; Materiais dentários; Infecção cruzada

Correspondence:
Darlene Ribeiro dos Santos Gerzson
dra.darleneribeiro@hotmail.com

Received: January 30, 2017
Accepted: August 3, 2017

Conflict of Interests: The authors state that there are no financial and personal conflicts of interest that could have inappropriately influenced their work.

INTRODUCTION

In dentistry, interest in infection control has increased over the years, particularly in relation to barrier precautions and instrument sterilization. Infection control is an important aspect of patient care in general, but it is particularly relevant for patients with HIV, cancer, or autoimmune diseases and transplant recipients. These patients' health may be compromised by infection with any microorganism, so the risk of pathogen transmission in dental procedures should always be considered [1].

One of the gaps in infection control is the paucity of research on dental materials supplied by the manufacturers in sealed containers [2]. Some materials have shown deficiencies, and microorganisms have been identified and isolated, for example, in the powder of impression material containers [3], as well as in instruments used in endodontics [4, 5] and orthodontics [6, 7].

In restorative dental treatment, gingival retraction procedures are part of impression techniques [8]. Although the use of retraction cords is relatively predictable, effective, and safe [9, 10], it can be challenging and time-consuming, can cause bleeding and be uncomfortable for patients. Also, when inappropriately manipulated, it can lead to injury and gingival recession and delay periodontal tissue repair [11-15]. Several studies on the effects of gingival retraction with the use of retraction cords on periodontal health have shown that this practice causes temporary gingival inflammation [16].

In its guidelines for hospital infection control, the Brazilian Ministry of Health recommends using the Spaulding classification of inanimate objects, according to the potential risk of infection associated with the material. This classification has been widely used in dentistry, and materials are divided into three categories: critical, semicritical, and noncritical items. All critical and semicritical items should be sterilized.

Retraction cords are considered critical items [17]. Therefore, because materials used for gingival retraction will be in direct contact with periodontal tissues, they must be free from contamination. However, few studies have investigated infection control and sterilization of dental materials as received from the manufacturer [2]. Contamination of gingival retraction cords in particular has received scant attention in the research literature. The present *in vitro* study was therefore designed to test retraction cords taken from factory-sealed containers for the presence of contamination.

MATERIALS AND METHODS

This was an experimental observational study, and the tests were conducted in the Microbiology Laboratory of the Centro Universitário da Serra Gaúcha (FSG), an institution located in Caxias do Sul, southern Brazil. All materials used in this study were purchased by the authors and there are no conflicts of interest.

The sample consisted of 10 1-cm segments of retraction cords of three different commercial brands (n = 30), which were provided by the manufacturer in sealed packages. Sterile brain heart infusion (BHI) broth with no cord or any other fungal or bacterial culture was used as the negative control group. In this study, there was no positive control group. The study groups are described in **Table 1**.

Table 1. Retraction cord groups

Group	Commercial brand	Manufacturer
1	Retraflex®	Biodinâmica -– Ibiporã, PR, Brazil
2	Pró-Retract®	FGM – Joinville, SC, Brazil
3	Ultrapak®	Ultradent – South Jordan, UT, USA
4 (negative control)	Sterile BHI broth	Himedia – Mumbai, India

BHI, brain heart infusion

Bacterial growth analysis

For microbiological analysis, 29.6 g of BHI broth were prepared by dilution in 800 mL of distilled water. The mixture was heated until dissolution and distributed into 30 test tubes (4 mL/tube). The tubes were then sterilized in an autoclave at 121ºC and 1 atm for 15 minutes.

The retraction cords were divided and then placed into test tubes containing sterile BHI broth, which were placed in the incubator at 35ºC for 48 hours. After this period, the medium turbidity was assessed for bacterial growth analysis. Bacterial growth was considered positive in tubes in which the BHI broth became turbid.

RESULTS

None of the control BHI broths showed turbidity, indicating absence of bacterial growth. This finding confirmed the efficacy of the method.

Of 30 test tubes with retraction cords, six showed turbidity: three tubes with Retraflex®, one tube with Pro-Retract®, and two tubes with Ultrapack®, accounting for 20% of the total sample.

DISCUSSION

Concern with professional and patient safety in dental care has given rise to several studies evaluating dental materials [18-21]. Some fields of dentistry have sought to assess the contamination of different materials supplied by the manufacturers in order to establish protocols of disinfection that should be adopted before their use in patients [22].

Rice et al. [2] evaluated retraction cords and irreversible hydrocolloids taken from sealed packages regarding the presence of bacterial contamination. One of the commercial brands that the authors analyzed was Ultrapak®, which was also evaluated in the current study. Similar to the present results, they found that 5% of the cords were contaminated.

In the field of orthodontics, Purmal et al. [6] assessed four different types of orthodontic buccal tubes received in sealed containers from the manufacturer, and anaerobic

bacterial contamination was found in all of them. The microorganisms isolated in that study were *Micrococcus luteus*, *Acinetobacter calcoaceticus*, and *Staphylococcus haemolyticus*. Contamination with these microorganisms may pose a potential risk to patients' health, and the authors suggested that these materials should be sterilized before clinical use. Gerzson et al. [7] assessed full cases and replacement brackets of four commercially available brands for microbial contamination using microbiological tests to detect the presence of bacterial growth and molecular tests (polymerase chain reaction [PCR]) to identify the bacteria present in the medium. The authors found microbial contamination by different types of microorganisms, suggesting that these materials should be sterilized before clinical use.

Regarding impression materials, particularly irreversible hydrocolloids, Casemiro et al. [3] tested six types of irreversible hydrocolloids and found viable bacteria and fungi in all samples. Likewise, Oskoee et al. [1] tested three commercial brands of irreversible hydrocolloids and found that 90% of the samples were contaminated. The authors of both studies recommended that this type of material should be packaged in single-use containers.

In 2006, Roth et al. [5] tested endodontic files received from manufacturers for microbial contamination. Using microbiological culture and PCR tests for bacterial identification, the presence of *Staphylococcus epidermidis* was detected in 13% of the samples. They also concluded that these instruments should be cleaned and sterilized before clinical use.

In a study that tested the contamination of gutta-percha cones used in endodontics, microorganisms were found as well [5]. Similarly, in the current study, retraction cords supplied by the manufacturers also showed microbial contamination, although the microorganisms present in the sample were not identified. Therefore, further studies are required to define the potential damage that these microorganisms may cause to patients' health [4].

Based on the present finding that retraction cords were contaminated in the packages supplied by the manufacturer, although in a small percentage, we also suggest that these instruments should be sterilized before clinical use to ensure patients' safety. Nevertheless, further studies on this topic are required in order to achieve a better understanding of this contamination process, including the quantification and pathogenicity of the microorganisms found in the samples by means of PCR tests, which can more accurately assess the potential risks of disease development.

CONCLUSION

The present study showed that some gingival retraction cords received from the manufacturers were contaminated with microorganisms. Because mechanical gingival retraction is an invasive procedure that, in some cases, may be associated with bleeding, facilitating cross-contamination, further studies on this topic are still needed to elucidate this issue.

REFERENCES

1. Guru R, Saleem M, Singh R, Patil A. Microbiological appraisal of three different brands of commercially available irreversible hydrocolloid impression materials: an in vitro study. J Contemp Dent Pract. 2011;12: 35-40. https://doi.org/10.5005/jp-journals-10024-1007
2. Rice CD, Dykstra MA, Gier RE. Bacterial contamination in irreversible hydrocolloid impression material and gingival retraction cord. J Prosthet Dent. 1991;65:496-9. https://doi.org/10.1016/0022-3913(91)90287-7
3. Casemiro LA, Martins CH, de Souza Fde C, Panzeri H, Ito IY. Bacterial, fungal and yeast contamination in six brands of irreversible hydrocolloid impression materials. Braz Oral Res. 2007;21:106-11. https://doi.org/10.1590/S1806-83242007000200003
4. Kayaoglu G, Gurel M, Omurlu H, Bek ZG, Sadik B. Examination of gutta-percha cones for microbial contamination during chemical use. J Appl Oral Sci. 2009;17:244-7. https://doi.org/10.1590/S1678-77572009000300022
5. Roth TP, Whitney SI, Walker SG, Friedman S. Microbial contamination of endodontic files received from the manufacturer. J Endod. 2006;32: 649-51. https://doi.org/10.1016/j.joen.2005.09.006
6. Purmal K, Chin S, Pinto J, Yin WF, Chan KG. Microbial contamination of orthodontic buccal tubes from manufacturers. Int J Mol Sci. 2010;11: 3349-56. https://doi.org/10.3390/ijms11093349
7. Gerzson DRS, Simon D, Dos Anjos AL, Freitas MP. In vitro evaluation of microbial contamination of orthodontic brackets as received from the manufacturer using microbiological and molecular tests. Angle Orthod. 2015;85:992-6. https://doi.org/10.2319/100414-711.1
8. Phatale S, Marawar PP, Byakod G, Lagdive SB, Kalburge JV. Effect of retraction materials on gingival health: A histopathological study. J Indian Soc Periodontol. 2010;14:35-39. https://doi.org/10.4103/0972-124X.65436
9. Benson BW, Bomberg TJ, Hatch RA, Hoffmam, W Jr. Tissue displacement methods in fixed prosthodontics. J Prosthet Dent. 1986;55:175-81. https://doi.org/10.1016/0022-3913(86)90336-7
10. Hansen PA, Tira DE, Barlow J. Current methods of finish-line exposure by practicing prosthodontists. J Prosthodont. 1999;8:163-170. https://doi.org/10.1111/j.1532-849X.1999.tb00031.x
11. Ruel J, Schuessler PJ, Malament K, Mori D. Effect of retraction procedures on the periodontium in humans. J Prosthet Dent. 1980;44:508-15. https://doi.org/10.1016/0022-3913(80)90069-4
12. de Gennaro GG, Landesman HM, Calhoun JE, Martinoff, JT. A comparison of gingival inflammation related to retraction cords. J Prosthet Dent. 1982;47:384-386. https://doi.org/10.1016/S0022-3913(82)80085-1
13. Azzi R, Tsao TF, Carranza FA Jr, Kenney EB. Comparative study of gingival retraction methods. J Prosthet Dent. 1983;50:561-5. https://doi.org/10.1016/0022-3913(83)90581-4
14. Feng J, Aboyoussef H, Weiner S, Singh S, Jandinski J. The effect of gingival retraction procedures on periodontal indices and crevicular fluid cytokine levels: a pilot study. J Prosthodont. 2006;15:108-12. https://doi.org/10.1111/j.1532-849X.2006.00083.x
15. Liu CM, Huang FM, Yang LC, Chou LS, Chou MY, Chang YC. Cytotoxic effects of gingival retraction cords on human gingival fibroblasts in vitro. J Oral Rehabil. 2004;31:368-372. https://doi.org/10.1046/j.1365-2842.2003.01237.x
16. Al Hamad KQ, Azar WZ, Alwaeli HA, Said KN. A clinical study on the effects of cordless and conventional retraction techniques on the gingival and periodontal health. J Clin Periodontol. 2008;35:1053-1058. https://doi.org/10.1111/j.1600-051X.2008.01335.x
17. Brasil. Ministério da saúde: Coordenação de Controle de Infecção Hospitalar. Procedimentos de artigos e superfícies em estabelecimentos de saúde. Brasília, 1994.
18. de Sousa JNL, Marques Filho A, de Sousa RL. Análise mcrobiólogica em ambiente odontológico. Rev Assoc Paul Cir Dent. 2007;61:308-88.
19. Barreto ACB, Vasconcelos CPP, Girão CMS, Rocha MMNP, Mota OML, Pereira SLS . Environmental contamination by aerosols during treatment using ultrasonic devices. Braz J Periodontol. 2011;21:79-84.
20. Rickli AC, Machado CEP, Silva LP, Guedes CG. Absortividade de fios de afastamento gengival embebidos em soluções adstringentes à base de cloreto de alumínio. Rev Odontol UNESP. 2007;36:71-6.
21. Prado MEM, Santos SSF. Avaliação das condições de esterilização de materiais odontológicos em consultórios na cidade de Taubaté. Rev Biociênc. 2002;8:61-70.
22. Leirião FP, Brito L, Mory M, Gioso, A. Histological study of the periodontal structures, comparing gingival displacement by use of copper band and by cotton string, in dogs. Braz J Vet Res Ani. Sci. 2003;40:382-8.