

DIFFUSION OF CORTICOSTEROID-ANTIBIOTIC SOLUTIONS THROUGH HUMAN DENTINE

Roberto HOLLAND*
Jacira N. OKABE**
Valdir de SOUZA*
Orlando SALIBA***

ABSTRACT: Three corticosteroid-antibiotic solutions were traced with methylene blue and then applied for five minutes into cavities prepared on extracted human teeth. The teeth were sectioned longitudinally and the infiltration areas photographed and evaluated with a planimeter of polar compensation. The two solutions with larger areas of diffusion on dentine were also analysed after a previous use of EDTA. There were significant difference among the results obtained in all the experimental groups.

KEYWORDS: Corticosteroid-antibiotic; diffusion through dentine.

INTRODUCTION

Corticosteroid has been applied to the floor and walls of deep cavities in order to prevent or alleviate dentinal and pulpal pain hypersensitivity to thermal stimulus^{1, 2, 10}. Some clinical and histological experiments showed that corticosteroid reduces postoperative sensitivity and inflammatory reaction^{1, 2, 10, 11, 13}. However this kind of observation was criticized¹² and there is someone that believes that the absence of pain following application of corticosteroids cannot be taken as evidence of a specific therapeutic effect⁶.

However, it is possible that the dentinal and pulpal hypersensitivity is solved by the reduction of the intrapulpal pressure. Van Hassel, McHugh¹⁴ observed that the intrapulpal pressure of teeth submitted to cavity preparations was highly increased

* Departamento de Odontologia Restauradora – Faculdade de Odontologia – UNESP – 16015 – Araçatuba – SP.

** Cirurgiã-Dentista – São Paulo – SP.

*** Departamento de Odontologia Social – Faculdade de Odontologia – UNESP – 16015 – Araçatuba – SP.

Nevertheless, when corticosteroid was applied to the floor of the cavities, the treated teeth exhibited an intrapulpal pressure nearest the one observed in the control group. The authors concluded that the ability of corticosteroid to suppress inflammatory vascular changes can prevent pressure induced by venous collapse beneath deep cavity preparations.

It is evident that an important factor that can influence the results, when corticosteroid is applied to deep cavities, is the ability of diffusion of corticosteroid on dentine. The subject of this work is to observe the diffusion of 3 corticosteroid-antibiotic solution on dentine of extracted human teeth.

MATERIAL AND METHODS

Forty extracted human maxillary central incisors were used in this study. Under standard conditions, cavities were prepared on labial and lingual walls of the cervical third of the roots, with a water-cooled high-speed handpiece. Thirty teeth were employed in the first part of the experiment. Each group of 10 teeth were used for a comparative study between two drugs. In 5 of each 10 teeth one brand of drug was applied to the labial cavities and the other to the lingual ones. On the other 5 teeth the situation was reversed.

The completed cavities were air dried under pressure and then filled with the following corticosteroid-antibiotic solutions: Panotil (Zambon) – Nitrofurazone, polymyxin B sulfate, Neomicyn Sulfate, fluorhydrocortisone acetate, lidocaine clorhidrate and an excipient. Otosynalar (Sintex) – fluocinolone acetonide, polymyxin B sulfate, neomicyn sulfate, lidocaine clorhidrate, citric acid, propilenglycol and distilled water. Otosporin (Wellcome) polymyxin B sulfate, neomicyn sulfate and hydrocortisone. All the corticosteroid antibiotic solutions received methylene blue in order to obtain a solution at two percent.

The cavities were full filled with the studied drugs for 5 minutes. After this time the cavities were washed with running water and dried with pressure air. The teeth were then sectioned longitudinally at the level of the two cavities. The sections were photographed and the obtained slides projected, all in a standard condition. The projected areas of the dye diffusion were traced in a paper and the obtained delineation was measured in mm² with a planimeter of polar compensation (Hope n^o 6678). The obtained data allowed the selection of two drugs that exhibited larger areas of dentin infiltration. These two drugs were again studied in another 10 teeth, with the same methodology described, but after the use of EDTA on the floor and walls of the cavities, for 2 minutes.

The statistical analysis of the obtained results was carried out using the Student's t-test for related data and for independent data, at a significance level of 0.05.

RESULTS

The mean of the diffusion areas observed in the different experimental groups can be observed on Table 1, the statistical analysis are on Tables 2 and 3 and the illustration on Figure 1.

The statistical analysis of the obtained data shows that: a – the mean of the diffusion areas observed with Otosporin is significantly higher than the mean of the diffusion areas observed with Otosynalar and with Panotil. b – the mean of the diffusion areas observed with Otosynalar is significantly higher than the mean areas of diffusion observed with Panotil. c – the mean of the diffusion areas observed with Otosporim – EDTA is significantly higher than the mean of the diffusion areas observed with Otosynalar – EDTA. d – the mean of the diffusion areas observed with Otosporim – EDTA is significantly higher than mean of the diffusion areas observed with Otosporin. e – the mean of the diffusion areas observed with Otosynalar – EDTA is significantly higher than the mean of the diffusion areas observed with Otosynalar. f – the mean of the diffusion areas observed with Otosporin and Otosynalar – EDTA were statistically similar.

DISCUSSION

In this work we analysed the diffusion through dentine of corticosteroid solutions with a composition different from that studied by other authors that analysed prednisolone associated top-chlorophenol, m-cresyl acetate and camphor^{1, 10, 11}. We preferred different formulations because the drug proposed by MOSTELLER¹⁰ has some components considered to be cytotoxic^{5, 9}. Otosporin was selected to be analysed in this work by the good results observed on the treatment of dental pulp and periapical tissues^{3, 4, 8}. Another reason was the interesting results we observed clinically with this drug in the treatment of dentinal hypersensitivity. The other drugs were selected in order to permit a comparative study between different formulations.

In this work we observed that Otosporin was the drug that showed the larger areas of diffusion on dentine. These data explain partially the better results observed with Otosporin, comparatively to others, when employed in the control of the periapical tissues reactions after vital pulpectomy^{3, 4}.

We also observed in this work that the use of EDTA enhances the diffusion of the studies drugs in a significant way. Besides this, we observed that with the use of EDTA, in 9 of cases Otosporin reached the root canal, while without EDTA only 4 cases showed the drug into the root canal. These facts suggest that with the use of EDTA a higher volume of the drug diffused on dentine in the limited time of 5 minutes. However, it is necessary to know better the consequence of the EDTA employment on dentine cavities. LINDERMANN et al⁷ analysed "in vitro" the diffusion of EDTA on dentine, as well as its influence on cellular respiration and cell culture. They observed that EDTA was toxic in the two tested systems, because EDTA chelates calcium ions, which are essential to many metabolic processes, as well as other essential metal ions. However, these authors⁷ believe that EDTA may be of negligible toxicity to the pulp when applied to intact dentine, because it fails to diffuse through that tissue to the pulp. It is possible that a quickly use of EDTA followed by a copious irrigation of the cavity with water should contribute to a better action of the corticosteroid solution without biological problems to the dental pulp.

TABLE 1 – Mean areas of diffusion, in mm², observed 5 minutes after the use of the drugs

GROUPS	DRUGS	MEANS
1	Otosporin	1499.0
	Otosynalar	683.6
2	Otosporin	1664.0
	Panotil	136.0
3	Panotil	255.0
	Otosynalar	667.0
4	Otosporin-EDTA	3357.0
	Otosynalar-EDTA	1555.0

TABLE 2 – Comparison between the drugs, Values computed of t (Student) for related date and critic value at a significance level of 5%

DRUGS	t value	Critic valume
Otosporin X Otosynalar	7.86*	2.262
Otosporin X Panotil	6.32*	
Panotil X Otosynalar	5.90*	
Otosporin-EDTA X Otosynalar-EDTA	5.24*	

* Significant

TABLE 3 – Comparison between the drugs, Values computed of T (Student) for independent date and critic value at a significance level of 5%

DRUGS	t value	Critic valume
Otosporin X Otosporin-EDTA	4.32*	
Otosynalar X Otosynalar-EDTA	3.21*	
Otosporin X Otosynalar-EDTA	0.22	2.101

* Significant

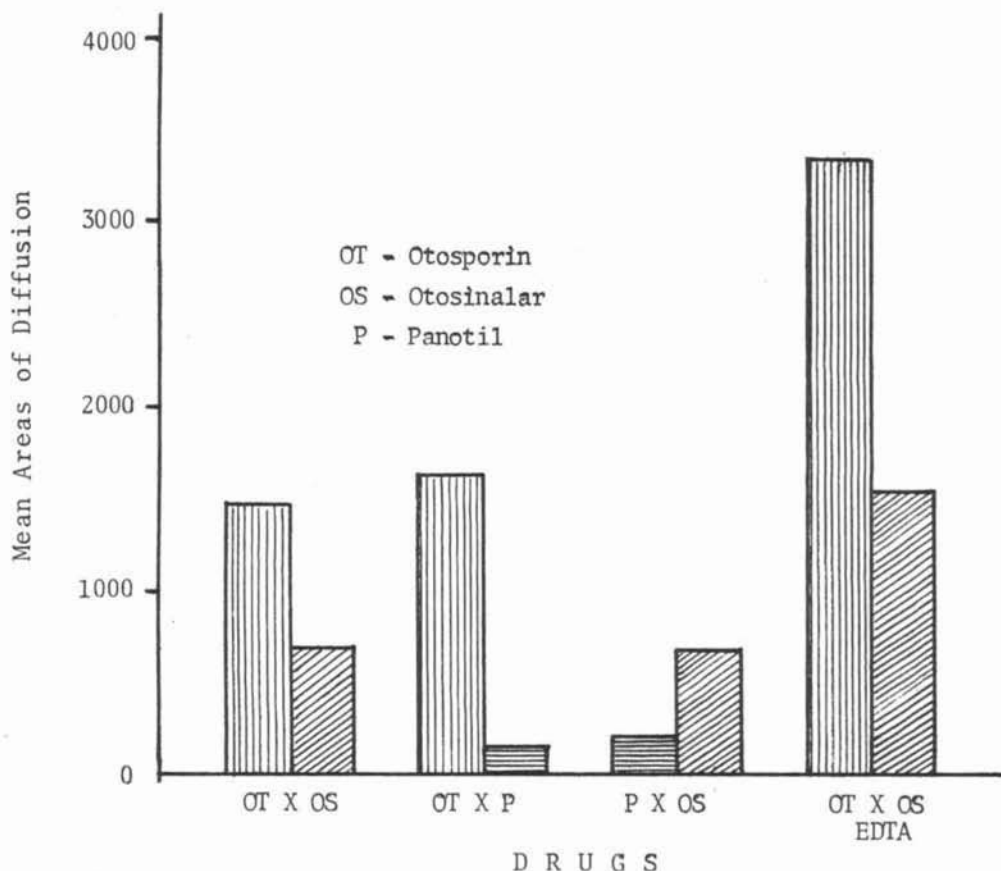


FIG. 1 – Mean areas of diffusion on dentine, in mm², observed 5 minutes after the use of the drugs.

The results of this work also show that there are significant differences in the diffusion of the studied drugs on dentine. It is possible that these differences on diffusion have a higher relation with the kind of excipient of the drugs. It is difficult to discuss the reason for these differences of diffusion on dentine because, with exception of Otosynalar, the others brands do not supply the employed excipients. But it is clear that if the subject of the treatment is the diffusion of the drugs on dentine, the selection of a drug with a high power of diffusion is very important. If this point was not observed the clinical results can be adverse and doubts about this kind of treatment can be introduced.

CONCLUSIONS

The data obtained in this work indicated that there are significant differences between the mean areas of diffusion on dentine observed with the studied drugs. The use of EDTA enhanced significantly the observed mean areas of diffusion.

HOLLAND, R. et al. Difusão de soluções à base de corticosteróide-antibiótico na dentina humana. *Rev. Odont. UNESP*, São Paulo, v. 20, p. 17-23, 1991.

RESUMO: Três soluções à base de corticosteróide e antibiótico foram marcadas com azul de metileno e aplicadas por 5 minutos em cavidades padronizadas, preparadas em dentes humanos extraídos. Os dentes foram partidos longitudinalmente e as áreas de infiltração fotografadas e dimensionadas com o auxílio de um planímetro de compensação polar. As duas soluções com as maiores áreas de infiltração na dentina foram também analisadas após a aplicação prévia de EDTA no assoalho da cavidade. Houve diferenças estatisticamente significantes entre os resultados obtidos em todos os grupos experimentais, evidenciando-se o maior poder de penetração, na dentina, da solução denominada Otosporin. Observou-se, também, que o emprego do EDTA aumenta significativamente a penetração das soluções estudadas.

UNITERMOS: Corticosteróide-antibiótico; difusão na dentina.

REFERENCES

1. DACHI, S.F., STIGERS, R.W. Effects of prednisolone on the thermal sensitivity and pulp reactions of amalgam restored teeth. *J. am. dent. Ass.*, v. 69, p: 565-71, 1964.
2. FRY, A.E., WATKINS, R.F. & PHATAK, N.M. Topical use of corticosteroids for the relief of pain sensitivity of dentine and pulp. *Oral Surg.*, v. 13, p. 594-7, 1960.
3. HOLLAND, R., NERY, M.J., SOUZA, V., MELLO, W., BERNABÉ, P.F.E., OTOBONI FILHO, J.A. The effect of corticosteroid-antibiotic dressing in the behaviour of the periapical tissue of dogs teeth after overinstrumentation. *Rev. Odont. UNESP*, v. 10, p. 21-5, 1981.
4. HOLLAND, R., SOUZA, V., NERY, M.J., BERNABÉ, P.F.E., MELLO, W., OTOBONI FILHO, J.A. Emprego da associação corticosteróide-antibiótico durante o tratamento endodôntico. *Rev. paul. Odont.*, v. 1, p. 4-7, 1980.

5. HOLLAND, R., SOUZA, V., MILANEZI, L.A. Behaviour of pulp stump and periapical tissues to some drugs used as root canal dressings: a morphological study. *Rev. bras. Pesq. méd. biol.*, v. 2, p. 13-23, 1969.
6. LANGELAND, K., LANGELAND, L.K., ANDERSON, D.M. Corticosteroids in dentistry. *Int. dent. J.*, v. 27, p. 217-51, 1977.
7. LINDERMANN, R.A., HUME, W.R., WALCOTT, R.B. Dentin permeability and pulpal response to EDTA. *J. prosth. Dent.*, v. 53, p. 341-3, 1985.
8. LOPES, H.P., COSTA, A.S. Pulpotomia como uma opção de tratamento ambulatorial: estudo preliminar. *Rev. bras. Odont.*, v. 44, p. 50-4, 1987.
9. MORAES, N.P., NERY, M.J., HOLLAND, R., MELLO, W., SOUZA, V., ROTHIER, A. Citotoxicity of three drugs employed in root canal treatment: histological study on dogs teeth. *Rev. Fac. Odont. Araçatuba*, v. 6, p. 81-9, 1977.
10. MOSTELLER, J.H. Use of prednisolone in the elimination of postoperative thermal sensitivity: a clinical study. *J. prosth. Dent.*, v. 12, p. 1176-9, 1962.
11. SAYEGH, F.S., BRANDT, R.S. Prednesol plus in pulp therapy. *J. oral Therap. Pharm.*, v. 3, p. 212-222, 1966.
12. SELTZER, S., BENDER, I.B. *The dental pulp: biological considerations in dental procedures*. Philadelphia: JB Lippincott Co., 1965, p. 62
13. TAKAYAMA, S., HOLLAND, R., RUSSO, M., KOMATSU, J., SASAKI, T. Zinc oxide-eugenol, calcium hydroxide and corticosteroids employed in the indirect protection of dental pulp. *Rev. Fac. Odont. Araçatuba*, v. 2, p. 237-47, 1973.
14. VAN HASSEL, H.J., MCHUGH, J.W. Effect of prednisolone on intrapulpal pressure. *J. dent. Res.*, v. 51 Abstracts of papers, p. 172, 1972. Abstract nº 499.

Recebido para publicação em 21/6/1990.