

RINSING OF THE ROOT CANAL

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Abstract

The authors studied the effect of physiological saline as an irrigant used to remove the smear layer during root canal cleaning. Two application techniques, involving either a syringe or ultrasound, were used and their outcomes were evaluated by scanning electron microscopy. Physiological saline was found to remove the smear layer imperfectly by both the syringe and the ultrasound method.

Key words

Smear layer, Root canal, Irrigation, Physiological saline, Ultrasound

INTRODUCTION

The quality of root canal obturation depends on root canal preparation, root canal filling material and the filling technique used (3). The final result will also be influenced by the amount of a removed smear layer. During root canal preparation, cut debris is smeared over the dentinal surface, forming a smear layer. The smear layer has been defined as any debris composed of organic and inorganic particles of calcified tissue, necrotic tissue, odontoblast processes and microorganisms. It has been described by scanning electron microscopy (SEM) as an amorphous substance with an irregular surface. *Mc Comb and Smith* reported that the smear layer was only loosely attached to the root canal wall whereas other studies demonstrated that the smear layer adhered firmly to dentine because it was difficult to remove (6). SEM studies have demonstrated that the smear layer covers the anatomical structures of the root canal. The smear layer thickness is not constant but ranges from 1 to 5 μm ; *Goldmann et al.* found that it varied between 10–15 μm (4) There are two layers The surface layer, i.e., smear debris (SD), covers the orifices of dentinal tubules and is 2 to 5 μm thick. It has higher density and a higher adhesive potential. The inner layer penetrates into dentinal tubules, occludes them and provides a natural barrier against fluid movement within the tubules. The smear layer thickness can be influenced by the type of a root instrument used and by the amount and composition of irrigants employed.

The smear layer composition has usually been studied in relation to the possibilities of its removal (1, 8). It has become apparent that only agents

combining both organic and inorganic solvents can effectively and totally remove smear layers (1). However, not only the combinations of agents but also the way of application and their quantity have been found to be important (8). The syringe application of irrigants, which is used most frequently, can be replaced by treatment of the root canal by ultrasound. In endodontics, the ultrasound technique utilises the mechanical and cavitation effect and acoustic streaming of ultrasound to remove the surface component of the smear layer. However, disinfectants and different concentrations of various acids, sodium hypochlorite and EDTA or their combinations cannot be used in all clinical cases. Their use may be limited by diagnosis such as a systemic disease, an adverse reaction of the organism, or when tooth apices are incompletely developed. In these cases, non-irritant materials should be preferred and physiological saline can be the material of choice.

The aim of this study was to evaluate the surface of the root canal after irrigation with physiological saline. Two application methods of irrigation were used.

MATERIALS AND METHODS

Twenty-two extracted, single-rooted teeth were used in the study. The extracted teeth were stored in 10% neutral formalin. Root canal shaping and cleaning was performed by the step-back technique. Physiological saline was used for irrigation. The teeth were divided into two groups. The first group was irrigated by the syringe technique, with 20 ml of the irrigant used per canal. Root canals of the other group were irrigated by the ultrasound method (Piezon Master Endo 400); the amount of physiological saline was the same as in the syringe technique. Following irrigation, the teeth were split open longitudinally and processed for SEM investigation. The samples were dried with alcohol, coated with vaporised gold and photographed in a Tesla BS 300 scanning electron microscope. The specimens of both experimental groups were investigated in the apical, middle, and coronal thirds of the canal separately.

RESULTS

SYRINGE TECHNIQUE

The smear layer covered the surface of a root canal along in its whole length (*Fig. 1*). Areas with exposed dentinal tubules were found only occasionally (*Fig. 2*).

ULTRASOUND TECHNIQUE

The root canal wall was covered by a continuous smear layer (*Fig. 3*) along the whole root canal length. Small areas free of any smear layer were identified only in the coronal and middle thirds of the canal (*Fig.4*).

The presence of a smear layer in the apical region was detected by both methods. The ultrasound method removed smear layers in isolated areas of the coronal and middle thirds of the root canal.



Fig. 1
Syringe technique, the coronal part of
a root canal after irrigation with
physiological saline.

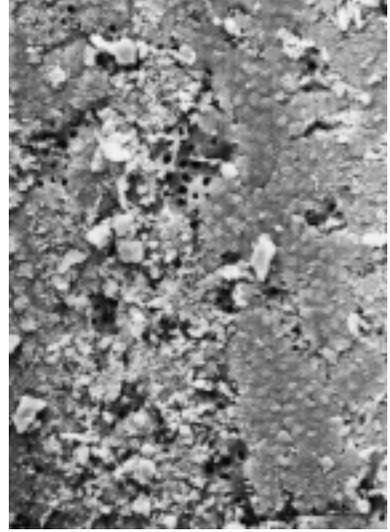


Fig. 2
Syringe technique, the coronal part of
a root canal after irrigation with
physiological saline.



Fig. 3
Ultrasound technique, the middle part
of a root canal after irrigation with
physiological saline.

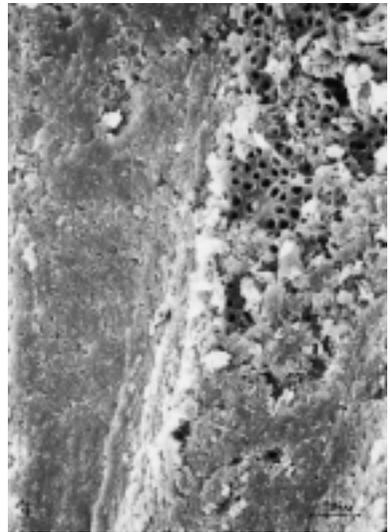


Fig. 4
Ultrasound technique, the middle part of
a root canal after irrigation with
physiological saline.

DISCUSSION

There are different opinions as to whether to remove or to preserve the smear layer. The preserved smear layer influences the movement of fluids in dentinal tubules, prevents penetration of microorganisms into dentinal tubules and reduces the permeability of dentine for toxins of oral bacteria. It may also reduce the cytotoxicity of filling materials. The smear layer prevents the dentine surface from being further wetted by an exudate from dentinal tubules, In addition to positive effects, the smear layer also has a negative influence because it prevents contact between the root canal wall and a filling material and makes the penetration of a filling material, disinfectant and irrigant into dentinal tubules more difficult. Microbes, which are always present in the smear layer, may finally cause disintegration of the smear layer. *In vitro* studies have demonstrated that the bacteria present in the smear layer may cause delayed pathological conditions and it has been confirmed that they are of secondary origin. *Chailervanikul et al.* found no statistical difference in microbial penetration in relation to the presence or absence of a smear layer (5). *Pallares et al.* demonstrated that no filling material penetrated into the dentinal tubules that were covered by a smear layer (7). So far opinions concerning either removal or preservation of smear layers have greatly varied. From the clinical point of view, the adhesion of filling materials to the root canal wall seems to be an important factor. Removal of the smear layer increases the ability of filling materials to penetrate into dentinal tubules (7). Irrigants used for smear layer removal can influence the adhesive force of root canal filling materials.

Physiological saline was found to remove the smear layer imperfectly with the use of either syringe or ultrasound methods. Irrigation with physiological saline should be used only in strictly indicated cases in which, for instance, the disinfectant may elicit a severe immunological response or there is a risk of damage to the mesenchymal papilla because the tooth has an incomplete apex.

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IRIGACE KOŘENOVÉHO KANÁLKU

S o u h r n

Práce studuje pomocí rastrovacího elektronového mikroskopu vrstvu "smear layer" vznikající po opracování kořenového kanálku. Hodnotí především její přítomnost v závislosti na aplikaci roztoku do kořenového kanálku injekční a ultrazvukovou technikou. Při užití fyziologického roztoku je vrstva smear layer nedostatečně odstraněna, a to u obou sledovaných irigačních technik.

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