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THE EFFECTS OF CO_2 LASER ON THE CEMENT OF HUMAN PERMANENT MOLAR. A SCANNING ELECTRON MICROSCOPY STUDY

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ABSTRACT: The cervical, medium and apical thirds of the roots of nine superior permanent molars, were irradiated by CO_2 laser, with simple and continuous discharges of 10 watts of energy. Afterwards, the roots were dehydrated, dryed, mounted in appropriated stubs and metalized to be examinating in a scanning electron microscope, JSM-P_{15}, Jeol. According to our results, the cervical and medium thirds presented a low groove, smooth surface, high and well delimited borders. On the other hand, when the simple discharge was used, a low depression, of round shape, circular borders and irregular adjacent area were observed. The apical thirds of the root, after CO_2 laser irradiation with simple discharge, presented a round foramen deeper than in cervical and medium thirds, smooth borders and irregular adjacent area with continuous discharge. This third showed the same characteristics of the cervical and medium thirds. Even in cervical, medium and apical thirds presented small projections of cement with various diameters in its borders.

KEY-WORDS: CO_2 laser; cement; scanning electron microscope.

INTRODUCTION

Recently, the carbon dioxide laser has become more widely available and now is utilized in many surgery fields. It is important to understand its biological effect on oral tissues, particularly on hard tissues.

The effect of CO_2 laser on oral tissues have been described by several authors [2,3,4,14,19]. STRONG *et alii* [16], GRASSER [5], TUFFIN & CARRUTH [18], utilized it in removing tumors; LIBERMAN *et alii* [10] and MELCER *et alii* [11], in the preparing of cavity and in restorative materials. YAMAMOTO *et alii* [20], LENZ & EICHLER [7], LENZ *et alii* [8], on mucous membrane.

On the other hand, the effect of CO_2 laser was reported by PECK & PECK [12], STERN *et alii* [15] and KANTOLA [6], in the enamel; KANTOLA [6] and LHUISSET [2], in the dentin structure; STERN *et alii* [13] and ADRIAN *et alii* [1], in the dental pulp.

This paper aims to show the CO_2 laser effects in different portions of the human cement, studied by scanning electron microscopy.

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MATERIAL AND METHODS

Nine superior permanent normal human molars were used in this study. The surfaces of the cervical, medium and apical thirds from each root were irradiated by CO_2 laser (mod. Sharplan - 733) with simple and continuous discharge of 10 watts of energy. Afterwards, the teeth were sectioned in small pieces and dehydrated in series of alcohols from 70° until the absolute. After drying, the specimens were mounted in the stubs and coated with gold ions in JEE-SS device, and examined in a scanning electron microscope, JSM-P_{15}, Jeol.

RESULTS

After the continuous discharge in the cervical, and in the medium thirds of the root, a low groove of smooth surface, high and well delimited borders were observed (Fig. 1). The adjacent region to this groove was presented with an irregular surface in contrast with the normal cement.

When the simple discharge was used a low crater was observed. The crater, surrounded by a smooth area, presented small projections (Fig. 2). In the adjacent region of exposed cement many small irregular trabeculae were found. Peripherally, it was observed the surface of normal cement (Fig. 3). In high magnification, the walls of the cavities in the cement formed by the laser showed melting processes (Fig. 4). The internal surface revealed an extensive area containing small foramina. In high magnification photomicrography, the superficial layer of the evaporated cement showed a trabecular structure with many irregular projections (Fig. 5).

In the apical third of the root, after the irradiation by CO_2 laser, a crater was formed which presented a rounded lip, deeper than in areas of the cervical and medium thirds (Fig. 6). In a close surrounding zone, an irregular area was formed by evaporation of the superficial cover of the cement. Other areas showed surfaces of normal cement.

The irradiated surface was characterized by the presence of some smooth areas and others with small projections and grooves. Many droplets of cement are found spread all over the extension of this surface (Fig. 7). In the lateral borders, small projections were verified. More externally, there were areas of irregular tissues as a result of the superficial cover of the cement evaporations (Fig. 8). In a more internal part, the development of small irregular areas revealing foramen of different diameters mixed to a straight surface was observed.

DISCUSSION

Our data revealed that direct laser impact on cervical and medium third of dental cement produced significantly different effects from those observed in the apical third of the cement. Nevertheless, in our findings it may be demonstrated that the cervical and medium thirds of dental cement present less penetration than the apical third. The destruction areas are perfectly delimited and also noted in both cases. They are accompanied by adjacent surface alterations.

STERN & SOGNNAES [14] demonstrated that glass-like surface on the enamel is more resistant to *in vitro* demineralization than adjacent unlased surfaces. According to our photomicrographies, we believe that the glass-like cement surfaces are also resistant. However, these areas in the cervical and medium thirds do not present any irregular

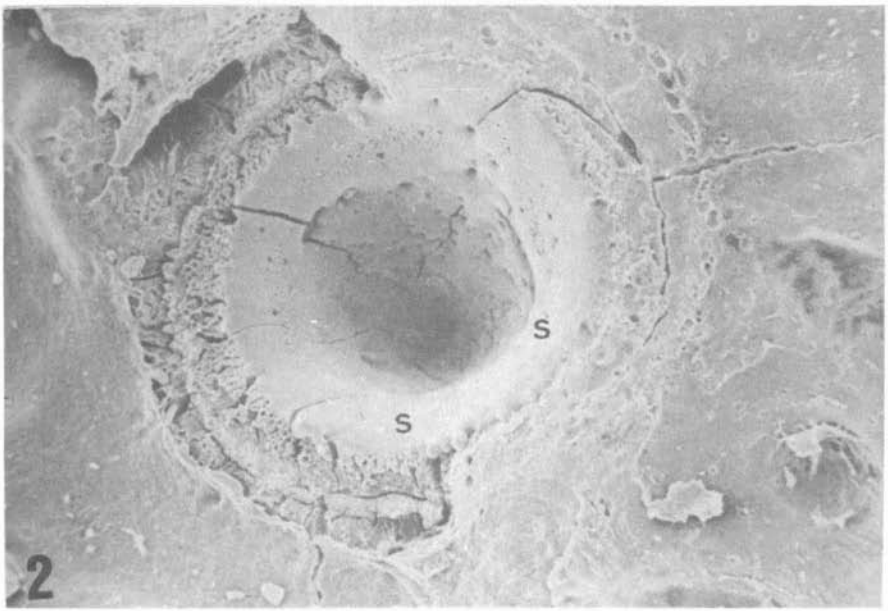


FIG. 1 - Cement. Irradiation in the medium third of the root with continuous discharge of 10 watts. A groove of smooth surface (S) and well delimited borders (arrows) are observed.
X 160

FIG. 2 - Cement. Medium third of the root, showed a simple area with a low depression of round shape, smooth and compact surface (S).
X 200

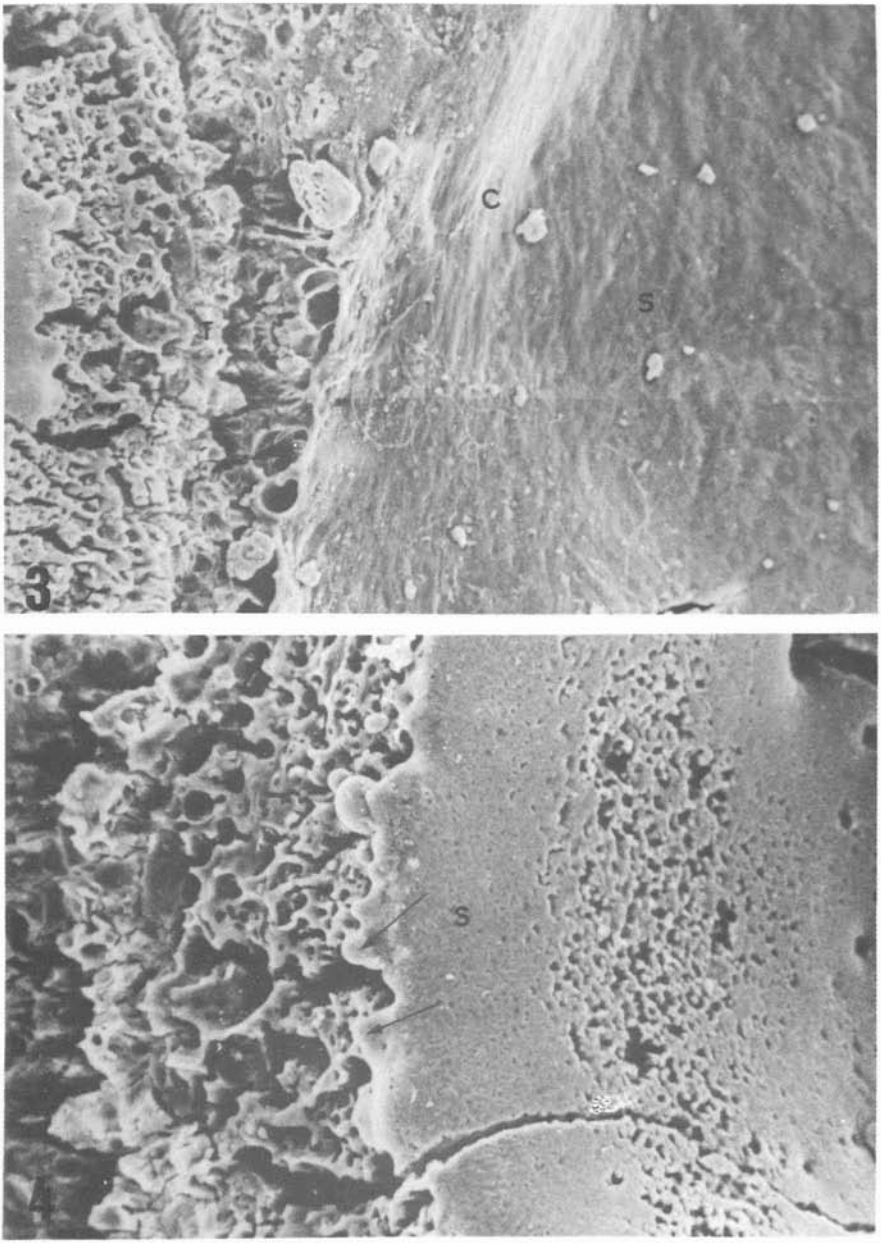
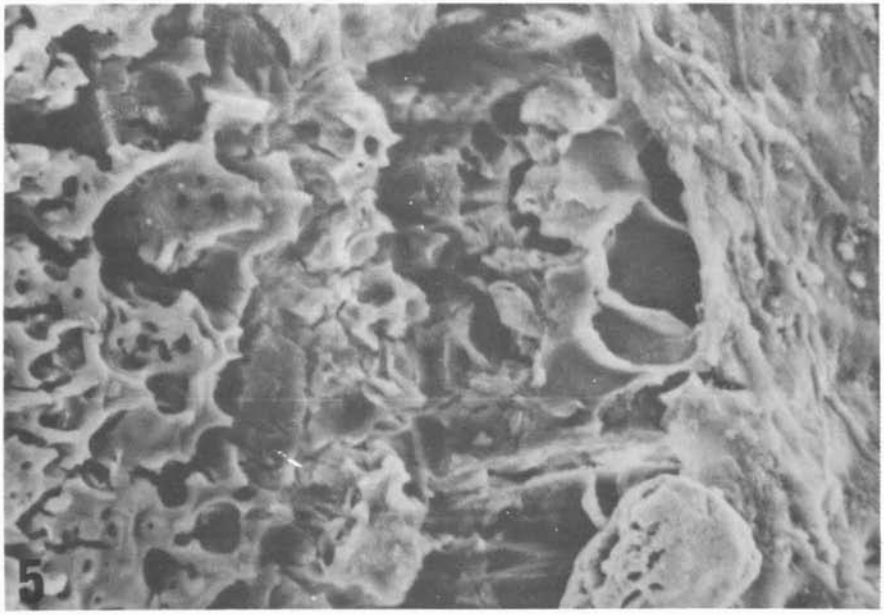


FIG. 3 - In high magnification, showed the characteristics of the adjacent cement with irregular trabeculae (T), normal cement (C) and smooth surface (S).
X 600

FIG. 4 - In high magnification, the borders of the smooth surface (S), with small projections of cement (arrows) are noted.
X 1000



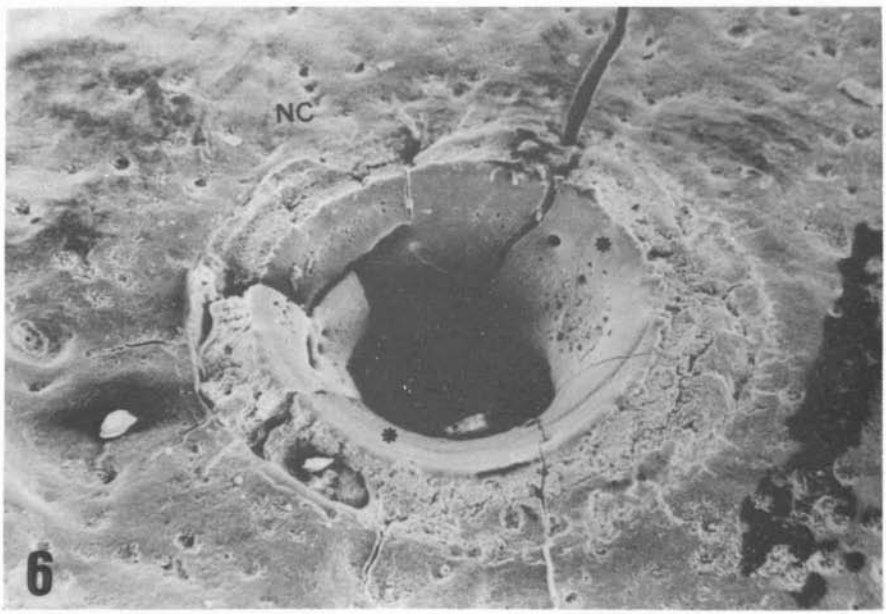


FIG. 5 - In high magnification, the different shapes of irregular trabeculae resulting of CO_2 laser irradiation are observed.
X 1600

FIG. 6 - Cement in the apical third of the root, showed the simple irradiation aspect. A deep depression of circular shape (*) and areas of normal cement (NC) are seen.
X 200

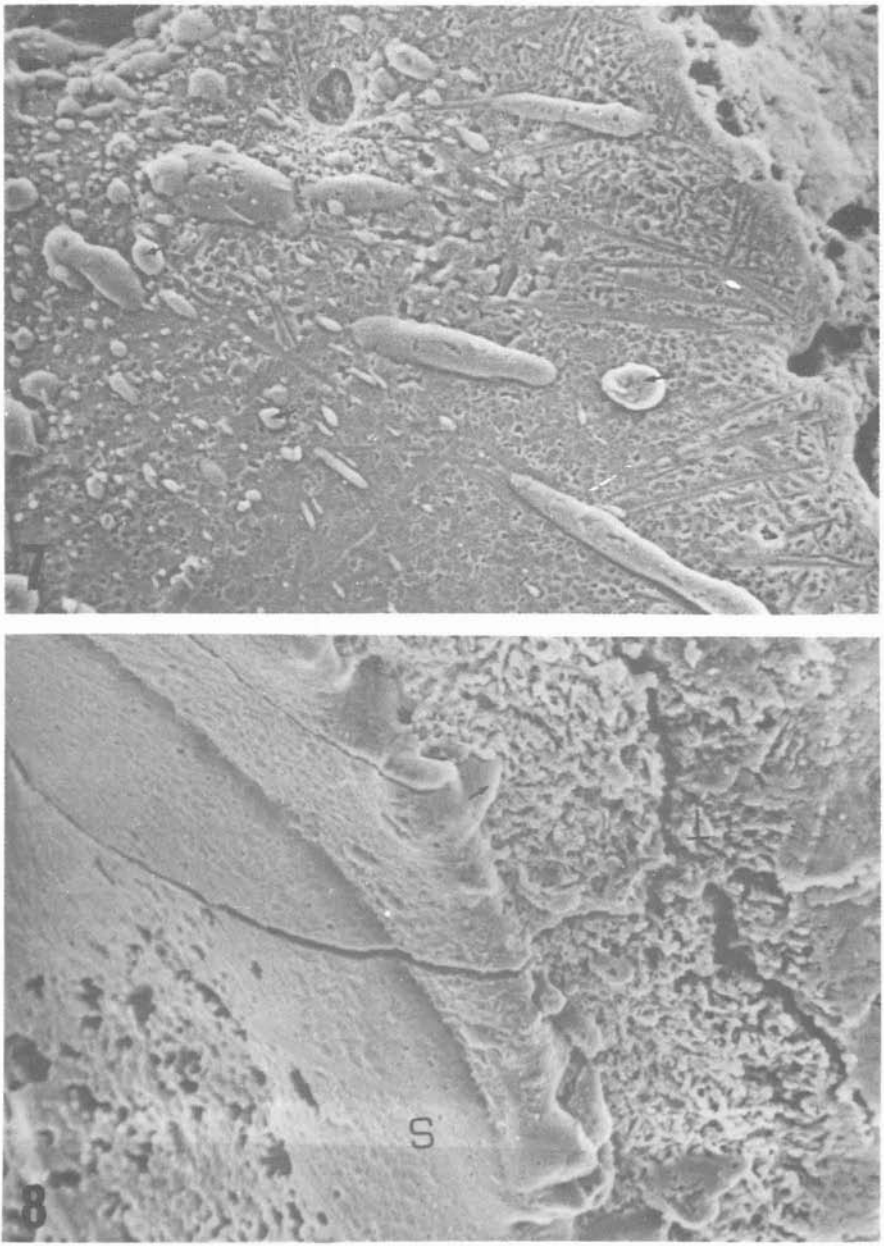


FIG. 7 - Photomicrography showing the cement droplets (arrows) of various sizes above the smooth surface.
X 1000

FIG. 8 - In high magnification, showed the characteristics of adjacent cement with irregular trabeculaeshape (T), small projection in the borders (arrows) and a smooth surface (S).
X 400

structures comparing to those observed in the apical third. So, it seems that apical glass-like area of cement is probably less resistant. STERN *et alii* [15] reported a significant effect of CO_2 laser on human enamel. Also, PECK & PECK [12] demonstrated the action of laser on the enamel and dentin structures.

GOLDMAN *et alii* [4] confirm that the ruby laser irradiated on the normal enamel caused changes with sharply demarcation. Also, TAYLOR *et alii* [17] reported the changes in the enamel of mandibular and maxillary incisors. Further evaluation of the CO_2 laser on the dental cement is needed to elucidate some other characteristics.

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RESUMO: Os terços cervical, médio e apical das raízes de 9 molares superiores permanentes foram irradiados pelo laser CO_2, com disparos simples e contínuos de intensidade 10 watts. Em seguida, as raízes foram seccionadas e desidratadas. Após a secagem, foram montadas em bases apropriadas e metalizadas para serem examinadas em um microscópio eletrônico de varredura, JSM-P_{15}, Jeol. Após o disparo contínuo, os terços cervical e médio apresentaram um sulco raso, de superfície lisa, margens elevadas e delimitadas, e quando foi utilizado o disparo simples, uma depressão rasa, de forma esférica, de bordas circulares de superfície lisa e compacta. O terço apical da raiz, após a irradiação pelo laser CO_2 com disparo simples, apresentou um forame esférico de profundidade relativamente maior que nos terços cervical e médio, margens lisas e área adjacente irregular. Com disparo contínuo, este terço mostrou as mesmas características dos terços cervical e médio. Tanto os terços cervical, médio e apical apresentaram nas margens pequenas projeções de cemento com diâmetros variados.

UNITERMOS: Laser CO_2; cemento; microscopia eletrônica de varredura.

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