Desenvolvimento de texturas cónicas em dentina processada por laser de excímeros.

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Short pulse duration UV lasers have been investigated as a possible alternative to IR lasers for hard dental tissue removal because they cause less thermal damage to the tissues [1] and, due to the short pulse duration, heat transfer to the pulp is limited [2]. Pulsed UV lasers can also be used for surface texturing of dentin or enamel, aiming to improve the adhesion of restoration materials to the tooth or to melt dentin superficially, thus sealing the dentinal tubules and reducing the penetration of pathogenic agents. The objective of this paper is to characterize the surface texture development in laser ablated dentin by scanning electron microscopy (SEM).

The samples of dentin were prepared by cutting 2 mm thick slices from the crown portion of extracted caries-free human molars using a diamond saw (Fig. 1a). The surface of the samples was ground and fixed using standard procedures [3]. Since the tubule orientation depends on the location in the dentin slice, only the central part of each sample was used, where the tubules are approximately normal to the surface (Fig. 1b). The experiments were performed in air, using a KrF excimer laser (λ = 248 nm, pulse duration of 30 ns) and a fluence of 1 J/cm^2. Observation of the surface topography were performed with a Hitachi S2400 scanning electron microscope.

Representative SEM images illustrating the evolution of the surface topography of the unprocessed dentin region shown in Fig. 2a with the number of KrF laser pulses are depicted in Fig. 2b to 2i. During the first 10 pulses, intertubular dentin is uniformly ablated while peritubular dentin melts and resolidifies as small globules that stand off the surface and occlude the tubules openings (Fig. 2b-e). As the number of laser pulses increases, the globules of resolidified peritubular dentin evolve to a cone-like morphology, and homothetically grow in height and base diameter until about 50 laser pulses (Fig. 2f-h). Finally, for a higher number of pulses (Fig. 2i), cones mutually impinge and their growth stops.

[1] B.C.M. Patel, J. Moss, G.J. Pearson, Laser Med. Sci., 9 (1994) 243.
[2] C. Turkmen, M. Gunday, M. Karacorlu, B. Basaran, J. Endodont., 26 (2000) 644.
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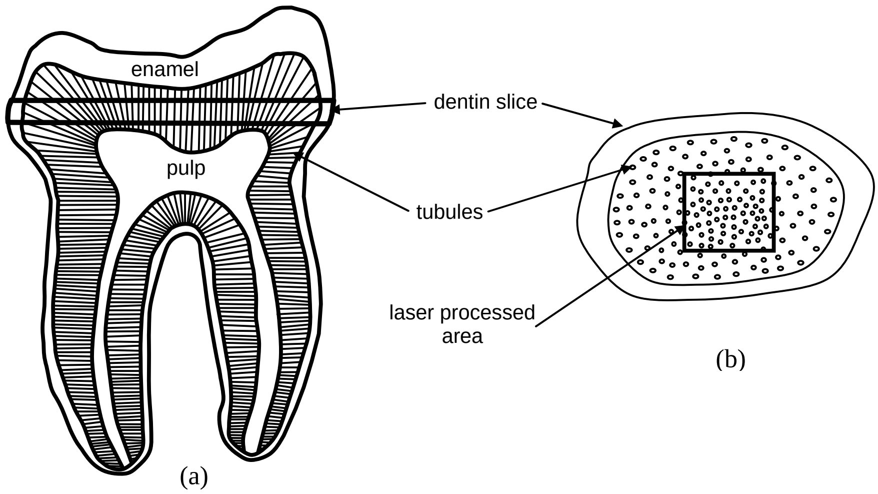

Figure 1 - (a) Schematic transverse cross-section of a human tooth; (b) tubule distribution in a slice of dentin cut perpendicularly to the tooth axis.

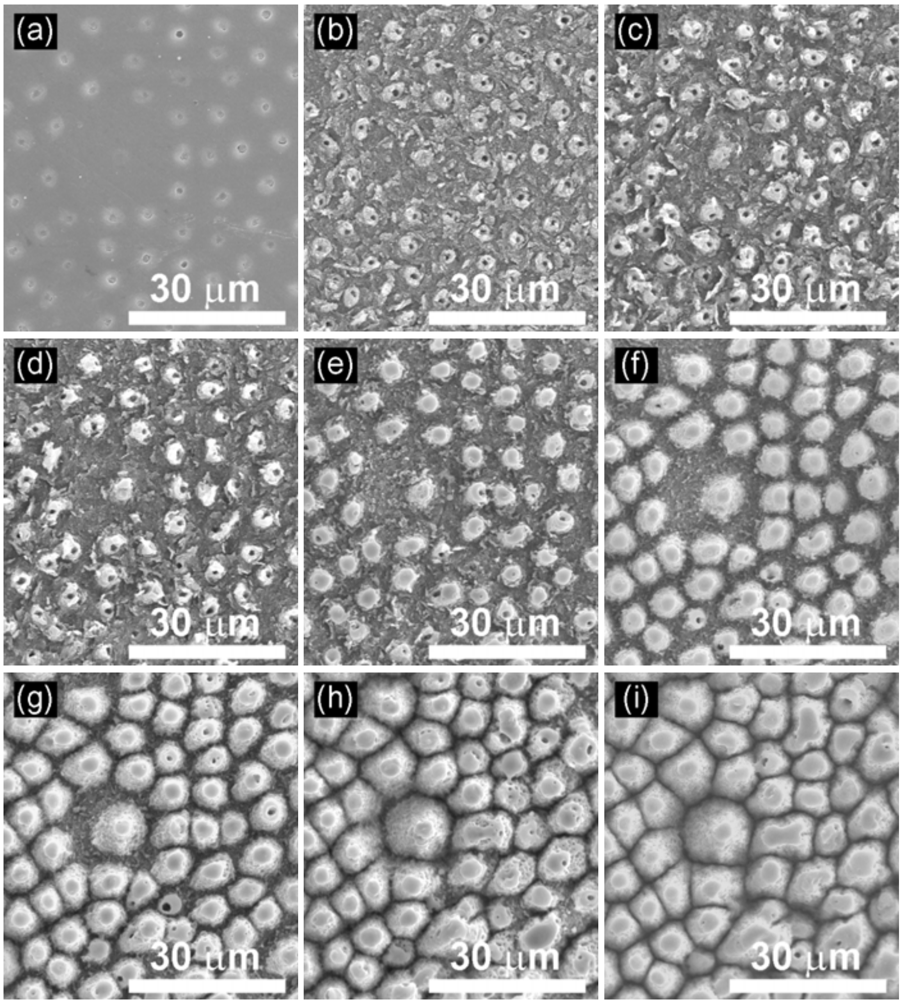

Figure 2 - SEM micrographs showing the nucleation and growth of cones with the number of laser pulses: (a) Initial surface; surface after (b) 1; (c) 3; (d) 5; (e) 10; (f) 20; (g) 30; (h) 50; and (i) 100 pulses.