Basic Research on the Rehardening of Demineralized Root Canal Dentin

Second Report: Strength of Core Resin Bonding to Rehardened Root Canal Dentin

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Abstract: Residual roots of teeth often have large amounts of softened dentin in the root canals, making the construction of an abutment impossible. Moreover, because removal of the softened dentin leaves only a thin layer of healthy dentin, the tooth is usually extracted.

In my first report I examined the rehardening or recalcification of softened dentin using nano-hydroxy-apatite (HA) as the experimental material. I artificially softened all the dentin in a tooth, and found that with active penetration of nano-HA to deep within the dentin, the artificially softened dentin could be rehardened to nearly the hardness of intact dentin. It was then necessary to investigate the bonding properties of rehardened root canal dentin, which is necessary for conducting prosthetic procedures.

Metal and resin materials are used in constructing abutments. It is reported that with resin the bonding strength is consolidated through direct bonding with HA. Therefore, in this study I investigated the bonding properties of soft root canal dentin that had been rehardened. The bonding strength of the resin filling the root canals was measured using a "punch through" method. The results showed that the bonding strength of artificially softened root canal dentin, which had been rehardened by using nano-HA, was approximately 35% of the bonding strength of intact root canal dentin. After nano-HA had been used to improve the bonding strength, 35% HEMA solution dentin primer was applied. As a result, bonding strength increased to 64%. The basic structure of dentin was seen and residual resin tags were observed in the dental tubules under SEM, confirming that hardening occurred through the action of nano-HA. Furthermore, after hardening, adhesive properties appeared.

Bonding strength increased with taper angle in the root canals. It was also found that bonding strength increased with the amount of nano-HA.

The results of this and my previous report indicate that softened dentin can be preserved, abutments constructed, and crown prosthesis procedures conducted without extracting the tooth. These findings highlight the possibility of more reliable treatment in the future.

Key words: Nano-hydroxy-apatite, Rehardening of softened root canal dentin, Core resin